AN ECONOMIC ANALYSIS OF A LARGE SCALE ASHE JUNIPER CLEARING PROJECT IN THE LEON RIVER WATERSHED

A Thesis

by

REBECCA LYNN FLACK

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2007

Major Subject: Rangeland Ecology and Management

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Approved by:

Chair of Committee, Richard Conner
Committee Members, Wayne Hamilton
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ABSTRACT

An Economic Analysis of a Large Scale Ashe Juniper Clearing Project in the Leon River Watershed. (May 2007)

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Chair of Advisory Committee: Dr. J. Richard Conner

Ashe Juniper (*Juniperus ashei*) is native to the Edwards Plateau in central Texas. In the past 150 years, however, this species has rapidly increased in abundance within its range. Reduced fire frequency and increased livestock grazing, are two factors attributed to the rapid rate of juniper encroachment. While the losses associated with brush encroachment are recognized, many ranchers lack the funds necessary to implement management practices to reduce juniper densities on their property. The high cost associated with clearing brush has led to the creation of cost-share programs, which help offset the expenses incurred by participating landowners.

The Leon River Restoration Project (LRRP), implemented on private lands within Coryell and Hamilton Counties, Texas, is one such cost-share program. Funding for the LRRP is received through non-programmatic sources, in the form of grants, from various state and federal organizations and agencies. The Natural Resources Conservation Service (NRCS) provides a second source of funding through the Environmental Quality Incentives Program (EQIP). Participants contracted through LRRP funds receive 85% cost-share benefits, up to a maximum of $15,000. Landowners participating in the LRRP under EQIP funds receive 50% cost-share incentives, up to a maximum of $250,000.

The purpose of this study was to record changes that occurred on land enrolled in the LRRP, following juniper removal, and the economic benefits recognized by this work. Thirty landowners scheduled to participate in the LRRP were interviewed in 2003, prior to juniper control work. In 2006, 23 of the original 30 landowners participated in a second interview, following their completion of brush removal work. Changes attributed to juniper removal were recorded during these post-clearing interviews. Stocking rate changes were used as the basis for measuring economic benefits recognized by the clearing efforts. Changes in hunting or grazing lease rates resulting from juniper clearing were also used to monitor economic benefits of the brushwork. A second component of the study tested for differences in landowner satisfaction between LRRP participants enrolled under LRRP funds, and those contracted under EQIP funds. Importance-performance matrixes were created to display satisfaction differences.

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CHAPTER I

INTRODUCTION

Brush encroachment represents a major monetary draw from the Texas economy. Although the losses associated with brush encroachment and subsequent control costs are recognized, many private landowners lack the funds necessary to implement a brush management program on their land. The high clearing costs have led to the creation of numerous cost-share programs across the state. Cost-share programs seek to help landowners offset costs associated with brush clearing by paying participants a specified percentage of the management costs, outlined in the individual program contracts.

The Leon River Restoration Project (LRRP) is a cost-share program that is being conducted on private lands in Coryell and Hamilton Counties, Texas, within the Leon River Watershed. The LRRP, modeled after a brush management program implemented on Fort Hood Army Base in central Texas, was started in 2001 by members of the Central Texas Cattlemen's Association (CTCA). Members of the CTCA organized the LRRP in an effort to extend brush control practices they had incorporated on Fort Hood onto private property within the 2 counties (Manning, personal communication, 2006). Two endangered bird species, the Black-Capped Vireo and Golden Cheeked Warbler, were the driving forces behind these brush control projects. By clearing Ashe Juniper (*Juniperus Ashei*), a native but highly invasive species within the Leon River Watershed and throughout much of Texas, members of the CTCA sought to improve and protect the endangered species habitat within the study area (Hamilton 2004). Brush clearing began

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This thesis follows the style of *Rangeland Ecology and Management*.

in May of 2001 and is ongoing today. Juniper clearing for the LRRP is done primarily with the use of hydraulic shears or a bulldozer, with a follow-up maintenance burn performed after clearing is completed. Participants in the LRRP may receive funding through LRRP sources, or through the Natural Resources Conservation Service (NRCS) using Environmental Quality Incentives Program (EQIP) funds. Funding for the LRRP is received from non-programmatic sources, in the form of grants, from various state and federal agencies and organizations (Manning, personal communication, 2006).

Landowners participating in the LRRP, with LRRP funding, receive 85% cost-share benefits, for a maximum of $15,000. The individual participants are responsible for covering the remaining 15% of the clearing costs, and pay that money into an escrow account. Upon signing up for the program, a private contractor visits the property and creates an individualized wildlife management plan for each participant. The management plans are written according to specifications published by the Texas Parks and Wildlife Department (TPWD). An Environmental Defense biologist is responsible for writing the endangered species habitat section of each management plan. Once written, a TPWD biologist reviews each plan, and if they find it acceptable, will approve the plan. The plan is then passed to the landowner, who, upon agreeing to the plan, signs it and enters into a contract with a non-profit agency called the Texas Watershed Management Foundation. Entering a contract with a non-profit agency ensures the privacy of the participating landowners in that their names are not released as they would be if they had been contracted through a federal or state agency (Manning, personal communication, 2006). By creating the LRRP cost-share program, individual landowners within Coryell and Hamilton Counties, Texas received not only funding

assistance for juniper clearing, but also technical assistance and an individualized wildlife management plan created for their property.

The contract length for an LRRP participant is 5 years. After clearing is completed, the landowner must implement a prescribed burn on the treated property within the remaining contract time frame. The cost of conducting this burn is paid for out of the 15% the landowner paid at the start of the project. If the landowner complies with the terms outlined in the management plan, money that is not used toward the burn or other implemented management practices, is returned to the participant upon completion of the project (Manning, personal communication, 2006). To date, the LRRP has received over $1,000,000 from non-programmatic sources and contracted over 80 participants since it was started in 2001. It is estimated that roughly 3,642 hectares (ha) have been treated. The project is ongoing with no known end date in sight (Manning, personal communication, 2006).

The Natural Resources Conservation Service (NRCS) also has a cost-share program called the Environmental Quality Incentives Program (EQIP), which issues funds to LRRP participants. Funds are allocated to the individual counties each year to support landowners selected to participate in the EQIP program. Because EQIP funds can be used for a variety of different agricultural management practices, NRCS uses a ranking system to determine which management practices receive the highest priority for receiving funds. This ranking system varies from state to state, county to county, according to what is deemed the highest management priority in each area. In Coryell and Hamilton Counties, brush management practices are generally considered to be a high priority, and receive the highest point value on the ranking system. A landowner

wishing to apply EQIP funds toward brush management practices only, will therefore generally receive the highest priority ranking. If an applicant is interested in using EQIP funds for several management practices, adjustments are made to each management practice according to its priority ranking, to determine the final ranking score for the landowner. In the event of a tie, applicant information is entered into a computer, which then randomly selects the landowners who will be eligible for EQIP funds that year. The number of applicants chosen in a year varies according to how many landowners apply, the amount of funding allocated for the year, and the cost of implementing the selected management practices for the landowners chosen. Applicants are chosen until the yearly funding allotment is contracted out (Ingram, personal communication, 2006).

There are 3 general stipulations an EQIP applicant must meet in order to qualify for funding. First, an applicant must own the land, or have an extended lease agreement of at least ten years (the maximum length of an EQIP contract) for the land they wish to perform management practices on. Second, the land an applicant wishes to enroll must have a current agricultural exemption. Land that does not have an Ag exemption is not eligible for EQIP funding. Finally, applicants can not earn more than $2.5 million per year if they wish to receive funds.

In Coryell and Hamilton Counties, landowners receiving EQIP funding are eligible for 50% cost-share incentives and can sign up for contracts ranging from 1 to 10 years. Landowners deemed as a limited resource landowner may be eligible for 90% cost-share incentives, however, no landowners eligible for this level of funding have applied for EQIP funds in either Coryell or Hamilton counties. Although landowners who are part of a partnership may be eligible for higher EQIP funding, an individual may

not receive more than $250,000. The $250,000 maximum may be met through a single contract, or be totaled through multiple contracts.

To date, 19 landowners have participated in the LRRP under EQIP funds. In Coryell County, an estimated 591 ha have been enrolled in the LRRP under EQIP contracts, while Hamilton County has enrolled an estimated 332 ha. Total EQIP funds spent in association with the LRRP for the 2 counties is approximately $77,000 and $35,000 from Coryell and Hamilton counties respectively (Lively, personal communication, 2006).

The intense clearing efforts of the Leon River Restoration Project created a unique opportunity for researching the effects of juniper removal on the impacted sites. In 2002, a meeting was held between members of the Texas A&M Agriculture Program associated with the Center for Grazinglands and Ranch Management (CGRM) and organizers of the Leon River Restoration Project to discuss the possibility of conducting research on treatment areas. A cooperative agreement was formed and has since allowed numerous professors and graduate students, from various departments and disciplines within Texas A&M University, to be involved with projects focused on studying the different clearing impacts associated with the LRRP. The four main research components being studied are: wildlife, range, watershed, and economics, although there is also a remote sensing component that is being researched as well (Hamilton 2004). These main research components coincide with the overall project objectives for the LRRP. The research conducted on recognized treatment areas is being conducted in two parts. Phase I of the LRRP research was conducted prior to Ashe juniper removal. The purpose of the Phase II component is to monitor the post-clearing changes. For the

economic section, a former A&M graduate student interviewed thirty landowners scheduled to have brushwork performed on their property. Pre-clearing interviews were conducted throughout the year of 2003.

Problem Statement

Although it is recognized that the removal of juniper on severely encroached lands can have numerous ecological benefits, the economic benefits and feasibility of conducting this sort of clearing have not been studied as intensely. The purpose of this study, therefore, was to perform an economic analysis on the Leon River Restoration Project and identify any economic changes that had occurred on the treated land since clearing was completed. Participants in the Phase I economic interviews were re-interviewed following juniper removal and any changes that had occurred due to brush clearing were recorded. Information obtained from this study will help future participants recognize the economic benefits, if any, which can be received from juniper clearing. These potential participants will also be better able to determine the economic feasibility of carrying out this sort of program on their property.

Goals and Hypotheses

The goal of this research project is to perform an economic evaluation of brush control methods (including follow-up maintenance practices) and restoration practices implemented in the LRRP. Specific items tested for significant differences in this study are:

1. Differences in net returns to livestock and/or wildlife enterprises due to brush clearing or restoration efforts based on changes in stocking rates or lease values.

2. Differences in satisfaction between landowners who participated in LRRP or EQIP funded contracts.
3. Changes in canopy cover and species, stocking rates, livestock production, and land use, due to brush clearing or restoration efforts.

Study Objectives

1. Develop a questionnaire to obtain information recording changes in production levels, land use, and enterprise costs and returns measured since Phase I of the LRRP.
2. Determine costs (including follow-up maintenance) of brush control and ecological restoration practices performed on land involved in the study.
3. Assess impacts of brush control and ecological restoration practices on production levels, input practices, and cost and returns budgets by enterprise and management unit.
4. Differentiate between results and satisfaction for landowners with LRRP contracted properties and EQIP contracted properties.

Study Area

The study area (Fig. 1) for this project includes private lands located within five sub-watersheds of the Leon River watershed. All sub-watersheds are located in Coryell and Hamilton Counties, Texas and include; Bullard Creek, Lower Beehouse Creek, Eagle Creek, Coryell Creek, and Plum Creek. Coryell and Hamilton Counties were chosen due to the ongoing research being conducted within the watershed and as a follow-up to brush treatment practices implemented during Phase 1 of the Leon River Restoration Project. Both counties are located within the Grand Prairie ecological region, which averages

710-810 mm of precipitation a year. Characteristic HCPC vegetation of a typical ecological site in this region includes numerous grass, forb, and woody plant species. Examples of identifying vegetation include; little bluestem (*Schizachyrium scoparium*), big bluestem (*Adropogon gerardii*), Indian grass (*Sorghastrum nutans*), sideoats grama (*Bouteloua curtipendula*), Texas wintergrass (*Stipa leucotricha*), live oaks (*Quercus virginiana*), elms (*Ulmus sp.*), Maximilian sunflower (*Helianthus maximiliani*), Englemann daisy (*Englemannia pinnatifidal*), and various other species. Land use within each county is typically devoted to rangeland, with cropland as the second highest use. Fort Hood Military Reservation occupies approximately 61,110 ha of the total project area, excluding Fort Hood land located in Bell County and outside of the project area. Much of that land is leased to members of the CTCA with grazing rights to the area (USDA 1985).

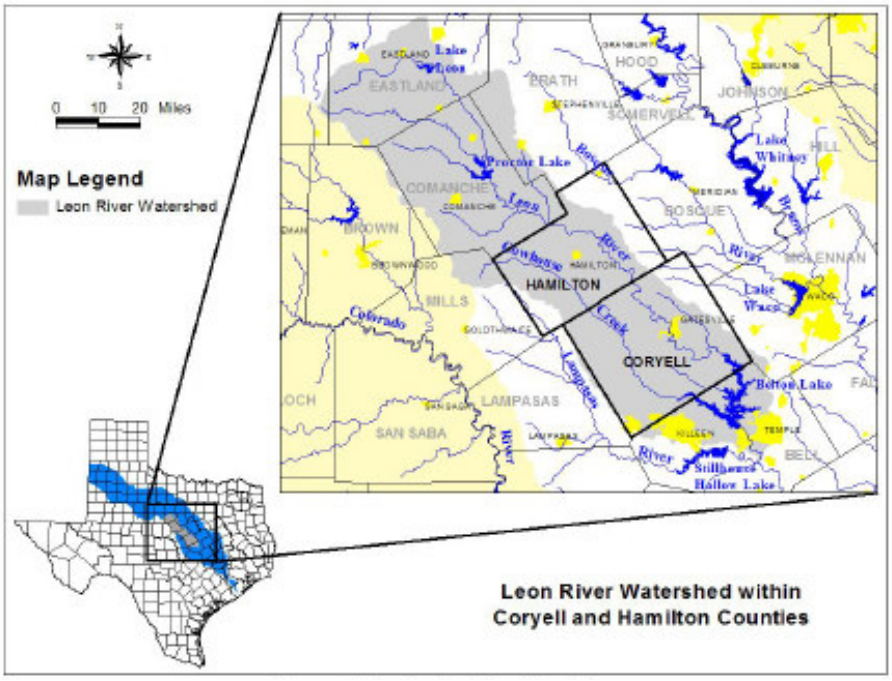

Figure 1. Map depicting the Leon River Restoration Project (LLRP) study area located within the Leon River watershed in Coryell and Hamilton Counties.

On an individual basis, Coryell County encompasses approximately 273,678 ha in area. It is characterized by 27 different soil series, with the Nuff, Doss-Real, Slidell, Real-Rock outcrop, Topsey, and Eckrant-Rock outcrop series comprising over 50% of the area. Elevation ranges within the county from 183-455 m (USDA 1985).

According to a 2002 census, Coryell County supported 1,221 farms and ranches, comprising 199,552 ha and approximately 73% of the land area. The average farm size in the county is 163 ha. Of the 1,221 farms and ranches recognized in the 2002 census, the landowners were split almost 50/50 between those who claimed farming as their principal occupation, and those who claimed something other than farming. Sales from livestock accounted for approximately 85% of the total agricultural sales within Coryell County. Of the agricultural enterprises in the county, cattle are considered to be the most important, accounting for approximately 81% of the total yearly sales. The average

yearly production expenses incurred by farmers are approximately $29,951, while the average net cash farm income is approximately -$1,190 (USDA 2002).

Hamilton County is approximately 216,531 ha in size. Elevation ranges from 274-488 m within the county. Thirty-nine different soil series are encountered within Hamilton county, with Real-Doss complex, Pedernales, Eckrant-Rock outcrop, and Krum silty clay being typical (USDA Unpub.).

Within Hamilton County, the number of total farms and ranches totaled 996 in the 2002 census. Farms and ranches account for approximately 84% of the total land area for the county at 181,981 ha. Average size for these farms and ranches is 183 ha with a median size of 100 ha. In Hamilton County, 56% of farmers and ranchers claimed farming as their primary occupation, which is slightly more than Coryell County. As in Coryell County, livestock production accounts for the highest number of agricultural sales for the county. Livestock, poultry, and their products account for approximately 94% or total agricultural sales, and like Coryell County, cattle are the top enterprise for the county. The average yearly production expenses incurred by farmers in Hamilton County are $29,951, while the average net cash farm income is approximately $4,042 (USDA 2002).

A Coryell County Appraiser noted that land values within the county have been on the rise in recent years. Land around Copperas Cove has the highest value in Coryell County at approximately $21,250/ha for a one to three hectare parcel of land. The same size piece of land around Jonesboro, Oglesby, or Evant, is valued at only $12,355/ha. For parcels of land with 162 or more ha, the Copperas Cove vicinity once again has the highest value at $6,919/ha, while Jonesboro is again lowest, at $2,965/ha. One of the

main reasons Mr. Hogg contributes to this price disparity is the proximity to a large metropolitan area. A shift in demand has caused property values to increase the closer the land is to a city, and become lower the more removed it is. Copperas Cove is the largest, and fastest growing city in Coryell County, while the three other towns noted above, are smaller and more rural (Hogg, personal communication, 2006).

Topography, land use, and land cover, also play a role in determining property values. Land which is flat, cleared, and devoted to cropland is generally the lowest valued property in the county. The reason attributed to this has been a change in demand as more people from metropolitan areas are moving into these rural locations. The newer landowners are generally more interested in using the land for recreational or hunting purposes, rather than agricultural purposes. The highest property values, therefore, tend to belong to land that is rugged, covered with brush, and if it has a water source and/or a view, the value is even greater. If, however, the new landowners can receive a tax break through an agricultural exemption by running some form of livestock on the property, they will generally take advantage of this. Leasing the land out, hiring a property manager, or running a small herd, are the most common ways these off-site landowners receive the exemption. The desire to implement a brush clearing program is met with about the same response as receiving an agricultural tax exemption. While most landowners do not want complete clearing performed on their land, if they can receive funding to remove some brush to make better wildlife habitat or create a more scenic view, they will take advantage of this opportunity (Hogg, personal communication, 2006).

Children and grandchildren of long-time farmers and ranchers, Hogg noted, are also tending to move away from the agriculture industry. As more landowners retire and pass the land onto their children, fewer of these children are interested in keeping the property in agriculture. As noted before, if they can receive an Ag exemption or funding to help with brush clearing, they may take advantage of these opportunities as well. The general interest, however, is in maintaining the property for recreation and hunting (Hogg, personal communication, 2006). A Hamilton County Appraiser confirmed a similar trend in land values and preferences is occurring within her district (Boatwright, personal communication, 2006).

The paragraphs above outline the intended goals and objectives for this project, as well as provide a brief description of the geographic and demographic information concerning the study area. In the following chapter, an overview of previously conducted research is provided, covering different aspects of brush control practices implemented throughout the state and surrounding areas. In the next chapters, the methodology for this study will be discussed, followed by the observed results. A discussion of these results and the conclusions drawn from the project will then be presented. The final chapter will also identify possible limitations of this study and suggestions for future research.

CHAPTER II

LITERATURE REVIEW

History of Brush Encroachment

Ashe Juniper (*Juniperus ashei*) is native to the Edwards Plateau in central Texas (Jackson and Van Auken 1997; Lyons et al. 1998; Scifres 1980). Prior to European settlement, the distribution of Ashe juniper was primarily limited to shallow ridge sites, stream floodplains, limestone outcrops, and the occasional scattered individual tree or motte within the open grasslands. In the past 150 years, however, this species has rapidly expanded and increased its abundance within its range (Bray 1904; Fuhlendorf et al. 1996; Jackson and Van Auken 1997; Rasmussen and Wright 1989; Smeins 1980). Research compiled from the Texas State Soil and Water Conservation Board showed that although areas of light, Ashe Juniper canopy cover (1-10%) had decreased from approximately 1.7 to 1.1 million ha (4.4 to 2.8 million ac) from 1987 to 1992 respectively, heavy canopy cover (> 30%) had increased from 0.48 to 0.77 million ha (1.2 to 1.9 million ac) (TSSWCB 2002).

Ashe juniper's rapid rate of encroachment can be attributed to several factors. Before European settlement, fires occurred frequently on the landscape. Whether started by natural causes, such as lighting, or by Native Americans, these fires had a major influence on shaping the composition of the plant community growing there (Smeins et al. 1997). Summer fires occurred frequently, burning in the hottest and driest conditions for days, weeks, and even months at a time (Taylor 2006). As more people began settling in Texas, fires became less frequent, allowing junipers to establish in once open grasslands and savanna habitats. Livestock have also expedited the brush encroachment

problem. Unlike native herbivores, whose grazing patterns ranged across much of the landscape, cattle provide continuous grazing pressure on smaller sections of land as they are fenced (Smeins 1980; 1983). Overgrazing depleted many of the more competitive native grasses, thereby allowing less competitive plants and woody species to encroach into these altered habitats. The constant grazing pressure also reduced fuel loads, resulting in lower fire frequency and intensity (Allred 1949; Smeins 1983; Fuhlendorf et al. 1996).

Archer (1994) offers another contributing factor for woody plant encroachment. Studies described in his paper identify increases of CO_2 in the atmosphere as a potential stimulant to juniper growth since the industrial revolution. The increased concentrations of CO_2 provide an environment more favorable to plants using the C_3 photosynthetic pathway (typically woody plants), rather than grasses, most of which use a C_4 photosynthetic pathway.

Birds and wildlife, along with the increased mobility of humans and animals, have also contributed to the increase in juniper distribution. Through their ingestion, seeds of the junipers were carried and dispersed to new and widespread areas (Ansley et al. 1995; Scires 1980). The American robin (*Turdus migratorius*) and cedar waxwing (*Bobycilla cedrorum*) were found to be two important seed distributors in the avian community, with the robin transporting seeds the greatest distances from the parent tree where seeds were consumed (Chavez-Ramirez and Slack 1994). Omnivorous animal species such as raccoons (*Procyon lotor*), ringtails (*Bassariscus astutus*), and foxes (*Vulpes fulva*) were also found to eat juniper seeds. Similar to the birds, successful germination and establishment of seeds eaten by these animals depended on them being dropped in an area

suitable for growth. Seeds eaten by climbing predators, such as the raccoon and ringtails, were thought to have better establishment success as they are often dropped under tree canopies, which are favorable for germination (Chavez-Ramirez and Slack 1993). The increase in juniper distribution may be expedited as a warming trend in the climate provides a stimulant for juniper growth (Smeins 1983).

Environmental Impacts

The increase in density and distribution of Ashe Juniper has had a number of impacts on the invaded landscape. Juniper is a major competitor to adjacent vegetative species. Its canopy shades out sunlight, while its extensive root system draws nutrients, minerals, and water away from less competitive plant species. The result is a reduction of forage vegetation in these juniper infested areas. (Lyons et al. 1998; Smeins et al. 1997).

Juniper may have a major impact on the natural hydrology of infested rangelands as well. The dense canopy cover, combined with a thick litter layer under the tree, gives Ashe juniper higher rates of interception and evapotranspiration than other grass and forb species. According to Thurow and Hester (1997), approximately 79.7% of rainfall is intercepted by the litter and canopy cover of junipers, allowing only 20.3% of rainfall to reach the soil below. In comparison, bunchgrasses and shortgrass cover allow approximately 81.9-89.2% of precipitation to reach the soil. The extensive root system of juniper also allows this brush species to utilize more water, both near the surface and deeper in the soil, making it much more competitive than other species during dry conditions. Because of its deep draw, less water is left for deep drainage and the recharge of underground aquifers (Thurow and Hester 1997).

Wildlife is also impacted by the encroachment of Ashe Juniper and other brush species. Although juniper provides valuable resources in terms of food and shelter for many wildlife species, large monocultures of the species do not promote wildlife diversity. Habitat fragmentation is a concern when determining where clearing should be performed and how much should be removed. The requirements of the wildlife species currently living in the area, and those being encouraged to return, must be taken into consideration when designing a management plan (Rollins and Armstrong 1997). Adding endangered species, such as the golden-cheeked warbler and black-capped vireo, to the mix makes the planning and preparation for brush control that much more important. Both species are native to the Leon River Watershed, and have been a driving force behind the Ashe juniper control efforts taking place for this project (Juarez et al. 2004).

Economic Impacts

In addition to the ecological effects mentioned above, brush encroachment represents a major monetary loss to the Texas economy. The gross annual economic loss due to brush problems in the Rolling Plains region alone was estimated to be in excess of 54.6 million dollars when $0.66/ kg ($0.30/lb) was received for the live calf weight (Kennedy 1970). One of the main factors contributing to economic losses on impacted lands is the reduction of forage production associated with increased brush cover. Study results provided by Lyons et al. (1998) for a range site near San Angelo, Texas show that in a range area with no juniper canopy cover, forage production is approximately 2,132 kg/ha (1,900 lbs/ac) with the carrying capacity around 8 ha/animal unit year (AUY). As juniper cover increased from a partially closed canopy to a closed canopy, forage

production was reduced from 1,297 kg to 318 kg/ha (1,156 lbs to 283 lbs/ac), while carrying capacities declined from 13 ha to 114 ha/AUY (33 ac to 283 ac/AUY), respectively. Rowan and Conner (1994) found a linear relationship between the decline of forage production and carrying capacity as canopy cover increased. After factoring time into the equation, they were able to create an exponential growth curve that projected carrying capacities until full canopy cover was recognized. In the Rolling Plains region of Texas, forage production declined by 12, 36, and 86.5% as brush cover increased from low, medium, and high canopy covers (Kennedy 1970). Another important, yet often overlooked, economic concern related to brush encroachment is the cost associated with increased difficulty in the care and handling of livestock (Dye II et al. 1995; Whitson et al. 1984; McBryde et al. 1984).

In addition to the losses associated with juniper encroachment, the benefits that can be accrued through brush control have also been studied. Johnson and Ethridge (1995) estimated a weighted average of $17.06/ha/yr ($7.08/ac/yr) increase when prescribed burning was implemented on impacted areas. When applied to the 80,800 hectares (200,000 acres) of juniper (Britton, 1994 cited by Johnson) controlled annually in Texas through prescribed burning, a total annual benefit of $1.42 million dollars was estimated. The total economic impact on the Texas economy as the result of increased forage production on this treated rangeland was $4.93 million dollars. While the losses associated with brush encroachment are recognized, many ranchers lack the funds necessary to implement management practices to reduce juniper densities on their property.

Economic Feasibility of Brush Control

The economic feasibility of implementing juniper control has been met with mixed results. It is generally recognized that the incorporation of a brush control program is a long-term investment, often requiring a large monetary investment before work is even performed, and benefits often extending several years into the future (Vantassel and Conner 1986). Whitson et al. (1984) indicated 15 to 20 years of analysis may be necessary when trying to determine all of the potential benefits attributed to rootplowing brush-infested lands.

In general, as juniper trees increase in age and size, so do the costs associated with their removal (Rowan and Conner 1994). For younger junipers, less than 1.2 m (4 ft) tall, prescribed fire has been shown to be one of the most effective methods of control, especially when used along with some form of mechanical treatment (Wink and Wright 1975; Johnson 1995). While it is also considered one of the least expensive brush control methods for immature stands of junipers, the economic benefits of conducting a prescribed fire may still not be enough to pay for the cost of implementing the burn. Because juniper trees less than 1.2 m (4 ft) tall generally do not have a great effect on forage production, a fire may not be able to produce enough additional forage to cover the costs of implementing the burn. A simulated case study by Rowan and Conner (1994) found that even when the internal rate of return from a fire was at its highest, it was still lower than the rate required to make the burn economically feasible. In addition to tree size and age, grazing deferments played a role in determining the economic feasibility for each burn simulation in this study. In some cases, maintaining current management practices, or doing nothing in terms of juniper control, may be the most

economical option for a landowner. Response curves depicted in Rowan and Conner (1994) provide visual representations comparing the responses of implementing different juniper removal options, versus the response of not implementing a control method.

On junipers greater than 1.2 m, and in very dense canopies, mechanical treatments are generally required. A graph by Rowan and Conner (1994) shows a projected increase in cost from $10.00/ha to 111.15/ha ($4.05/ac to $45.00/ac) where prescribed fire and dozing are used respectively for treatments. A study evaluating a combination of livestock grazing and 3 different forms of brush control was conducted by Whitson et al. (1984) in the Edwards Plateau region. Initial treatments of root plowing, power grubbing, and aerial spraying using 2,4,5-T and Picloram were performed and analyzed over a 10-year period. In this study, Ashe Juniper was found to be resistant to aerial spraying, while grubbing was found to be an effective control method for juniper in this study area. Both methods, however, were found to be economically unfeasible in this study, in terms of the potential to increase gross sales, as well as decrease the variability in annual gross sales. The effects of rootplowing appeared to be higher and more long-term in nature, however the economic feasibility for this control method was still considered to be low. Whitson et al. (1984) suggests monitoring beyond the 10 year time frame represented in this study may be necessary to evaluate the economic effectiveness of rootplowing juniper. In addition to the brush control method implemented, the grazing system utilized by landowners also plays an important role in determining livestock productivity. Both factors are especially important during drought conditions. Whitson et al. (1984) mentioned income tax benefits and cost-sharing arrangements as factors that

had the potential to influence the economic feasibility for different control methods depending on individual situations.

An experiment conducted by Reinecke et al. (1997) compared prices for several juniper control methods implemented in varying canopy cover classes. Treatment methods included the use of individual plant treatments with herbicide, mechanical methods of roller chopping and double chaining, and prescribed fire for maintenance purposes. Six woody class cover scenarios were recognized, ranging from a low woody canopy cover of 3% to high canopy covers of 75%. While the results indicated the greatest increases in forage production occurred after clearing sites with high brush concentrations, these areas were also more expensive to treat than sites with lower juniper densities (Reinecke et al. 1997). Although it is more expensive to treat areas of high brush concentrations, once junipers pass the height where prescribed fire is considered an effective control method, closed canopies may be the next opportunity for an economically feasible clearing option. Partially closed canopies were found to be the least economically viable option for clearing with regard to the costs of treatment and the recognized benefits (Rowan and Conner 1994).

The use of hydraulic shears for the clearing of Ashe juniper is a relatively new treatment method. While shearing effectively kills these non-resprouting junipers, the cost is highly variable depending on site conditions and operating expenses associated with the contractors who run the machines. In one study, the shears were billed at a rate of $65.00/hr, with the cost per hectare ranging from $185.25 to 926.25 ($75.00 to $375.00/ac). Juniper density and the presence of stumps, rocks, slopes, and hardwood

tree species mixed with the junipers were factors attributed to the variable price range (Jones and Conner 2004).

Although most literature to date indicates mechanical methods of control are necessary for clearing large junipers, recent research conducted at the Texas Agricultural Experiment Station in Sonora has shown that summer burns are also an effective method for killing these trees. The ideal conditions Taylor lists for conducting a summer burn are; low humidity (20-35%), dormant and dry vegetation and litter, and high temperatures (> 90^{o}F). Wind is another major factor that must be taken into account. Burns conducted in these conditions require less fuel to carry the fire, allow litter under the trees to burn into the stand, and heat the plant tissue to higher levels than a winter fire would. Taylor notes that the burning and smoldering of litter under the trees for days after a burn is completed is very effective at killing the larger junipers. Summer burns are riskier to conduct, however, and require a high amount of detail and planning, before, during, and after the burn has been completed. Although summer burns may be more cost efficient than mechanical treatments, individual land owners who are not involved with a burn association may find it difficult to obtain a burn permit during these extreme conditions, especially if there is a burn ban (Taylor 2006).

Factors Contributing to Landowner Participation in Brush Clearing Activities

A number of surveys and studies have been conducted in an effort to determine factors influencing landowner decisions on whether or not to participate in juniper clearing activities. Brush control efforts often involve a high implementation cost followed by results which extend over an unknown length of time, often making landowners hesitant to participate in such methods. In many cases land managers feel the

uncertainty of economic variables, such as livestock prices and production costs, which change from year to year and influence the profitability and affordability of such management practices, make investments in brush management too risky (Ethridge et al. 1994). These results agree with a study conducted by Hanselka et al. (1990), which also indicated livestock management considerations must be taken into account when deciding upon brush clearing activities. Unpredictable environmental issues, such as the amount of rainfall, were also shown to be a concern of individuals (Hanselka et al. 1990). The attitudes and fears of neighbors' potentially had a negative influence on landowners' decisions to implement weed or brush treatments as well (Rowan et al. 1994).

The high cost associated with clearing brush has led to the creation of cost-share programs which help offset the expenses incurred by landowners participating in brush clearing activities. Factors influencing participation of individuals in these programs were researched by Tays (2001) and Olenick et al. (2005). Landowners that are more financially dependent on their ranches as a primary source of income were found to be more willing to participate than land managers owning the land for other purposes. However, larger landowners and those generating a higher income from wildlife enterprises were also more likely to consider a cost-share program for clearing juniper. In general, the longer a rancher had lived on the property, the more likely they were to incorporate brush clearing activities onto their land (Tays 2001). Olenick et al. (2005) found that there was an interest for landowners in brush management programs directed towards reducing woody plant cover, improving water yields, wildlife habitat, and restoring more open grasslands. Unless there was some sort of public compensation to

help assist with clearing costs, however, the enthusiasm to participate was higher than the actual willingness to do so.

Research performed and compiled by Hamilton and Conner (2000) analyzed several different brush control practices and the implementation of various follow-up maintenance methods. It was found that incorporating some sort of management treatment following initial brush removal efforts, whether mechanical, chemical, biological, or a prescribed burn, extended the benefits of brush removal beyond the treatment life for the control method if follow-up practices were not implemented. Higher returns on investments were recognized when maintenance treatments were performed following the initial treatments versus the returns obtained when no follow-up was performed. Figure 2 represents a generalized response curve depicting changes in carrying capacity that can occur following an initial brush control treatment. The curve shows the increase in carrying capacity after the brush control treatment is implemented. After reaching maximum production level, the carrying capacity stabilizes for several years. With regular maintenance treatments, such as prescribed burns, this elevated carrying capacity level by may be maintained by controlling brush regrowth. When follow-up maintenance treatments are not implemented, carrying capacity will decline back to the initial level as juniper encroaches back into the system. The response curve also shows the decline in carrying capacity that can occur when no initial brush control treatment is performed. Although follow-up maintenance practices help increase the internal rate of return over that recognized when no follow-up practices are incorporated in the plan, Hamilton and Conner (2000) state that landowners may still require additional sources of revenue to implement brush management practices. Cost-share

programs and wildlife hunting leases are two additional sources of revenue the authors mention may help land managers offset some of the brush management costs.

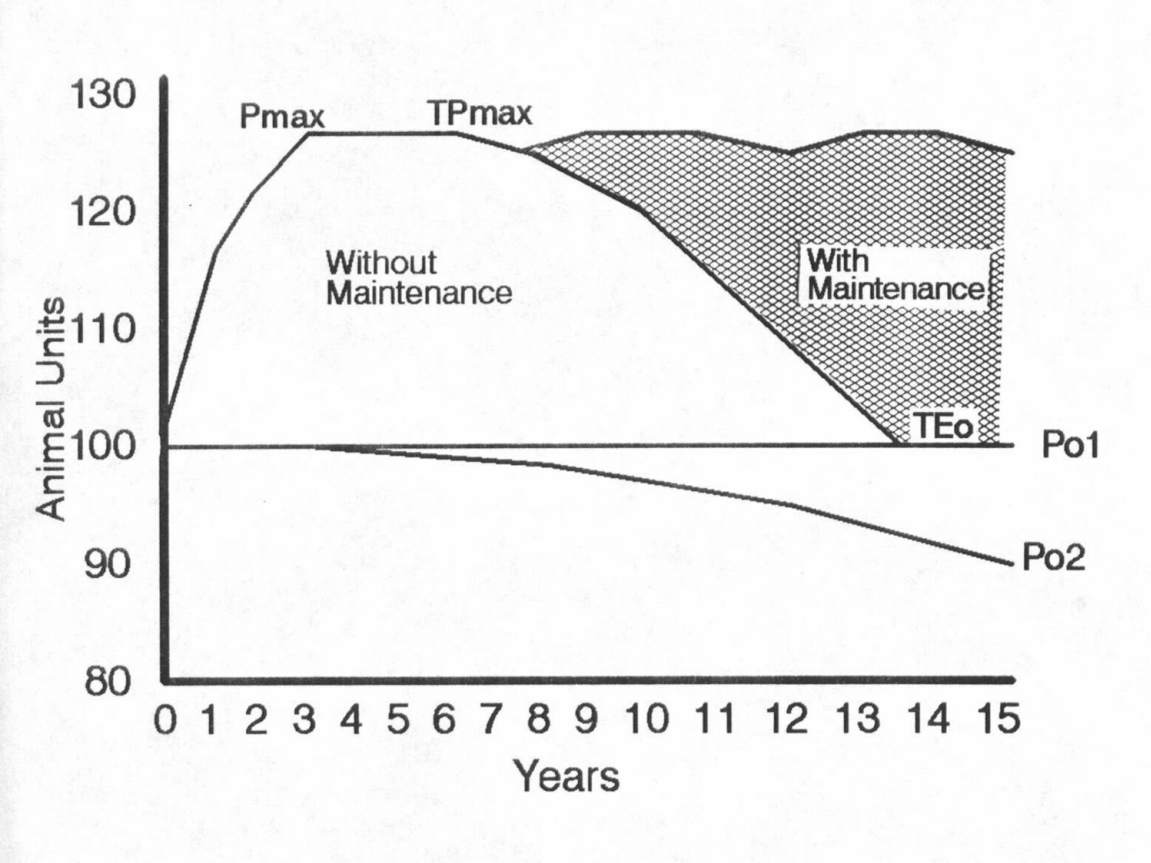

Figure 2. Generalized response curve depicting changes in carrying capacity after an initial treatment for brush control and a series of maintenance treatments. The response curve also depicts changes in carrying capacity when no control treatment is implemented, Po2. Pmax = maximum production level, TPmax = expected longevity of maximum production, Po1 = initial carrying capacity, TEo = expected point in time when treatment effect is exhausted and (Hamilton and Conner 2004).

Brush Control Programs

Brush Busters is one example of a program designed to reduce juniper densities with lower cost expenditures to the landowner. Brush Busters was developed in 1995 as part of a joint effort between the Texas Agricultural Experiment Station and the Texas

Agricultural Extension Service to find a cost effective strategy for treating juniper and other brush problems. The program concentrates the efforts of landowners on treating younger, more susceptible plants with herbicide. Using this approach, known as "individual plant treatments" (IPT), the amount of herbicide applied for juniper control is lowered because plants more likely to be affected by the chemicals are targeted. This program has been attractive to land managers due to its low cost, convenience, and the availability of information and training regarding it (Kreuter et al. 2001).

The Leon River Restoration Project (LRRP), as discussed in the 1st Chapter, is an ongoing Ashe Juniper clearing project implemented in Coryell and Hamilton Counties, Texas. Table 1 represents the clearing costs for projects contracted using LRRP funds and resources. Clearing costs were calculated when the billing rate for the hydraulic shears was valued at $65.00/hour (Jones and Conner 2004). The billing rate for the machines is estimated to have risen in the past few years to $70-$75.00/hour (Manning 2006).

Table 1. Mean, standard deviation, median and 95% confidence interval for costs of treatment practices associated with juniper removal in the LRRP study area.

Treatment Practice	Total Sites	Mean	Standard Deviation	Median	95% Confidence Interval
Clearing (All Sites, $/ha)	28	$516.44	$231.29	$450.22	$428.47 - $607.87
Clearing (Posted Sites Only, $/ha)	5	$805.05	$80.06	$830.50	$705.72 - $904.39
Clearing (Non-Posted Sites, $/ha)	23	$455.90	$204.35	$373.37	$367.44 - $544.11
Seeding ($/ha)	6	$55.60	-	-	-
Compost Hauling ($/ha)	4	$34.10	$9.39	$37.81	$19.52 - $48.93
Compost Material ($/ha)	4	$44.73	$31.38	$52.39	($5.19) - $94.89
Total Cost ($/ha)		$652.59			

The Environmental Quality Incentives Program (EQIP), also mentioned in Chapter I, offered through the Natural Resources Conservation Service (NRCS) is another program which offers farmers and ranchers cost-share incentives for conservation work performed on their property. To date, 81 landowners, 26 from Coryell County and 55 from Hamilton County, have participated, or are currently contracted, under the brush clearing funds of EQIP. In Coryell County, an estimated 9,713 ha (24,000 ac) have been cleared, while an estimated 17,014 ha (42,040 acres) have been cleared in Hamilton County. Total EQIP funds spent for the 2 counties is estimated at $390,000, $272,000 from Hamilton County and $118,000 from Coryell County (Lively 2006). The number of participants, and associated funding and enrolled area, in the LRRP under EQIP contracts can be found in Chapter I.

In 1986, the Texas State Soil and Water Conservation Board (TSSWCB) introduced a new state brush control program offering cost-share assistance to landowners in an effort to try and increase water yields by clearing problem species. The TSSWCB program focuses its efforts in areas receiving an average of 410 to 910 mm (16 to 36 in) of rainfall a year, as they have found these areas have generally shown the greatest response for increased water yields following brush removal. The amount of cost-share a landowner may receive is determined by a ranking system set up by the individual districts eligible for the program (TSSWCB 2002). To date, over 31 million dollars has been allocated for brush removal in 8 watersheds determined to be critical areas, while approximately 250,105 ha (618,000 acres) of land have been treated. The 8 watersheds targeted in this program are the: North Concho River, Twin Buttes,

Pedernales, Lake Ballinger, Oak Creek Lake, Champion Creek, Pecos/Upper Colorado, and Mountain Creek (Wood 2006).

CHAPTER III

METHODOLOGY

Landowners

In 2003, 30 landowners scheduled to have brush work preformed on their property in Coryell or Hamilton Counties, Texas, were interviewed as part of the Phase I portion of the LRRP. In circumstances where the landowner was not available or actively involved with the management of his/her ranch, the primary operator or lessee was contacted and asked to participate instead. Interview participants were contracted for brush work using either LRRP or EQIP funds.

Landowner Interview Process

Phase II of the economic portion for the LRRP included follow-up interviews with the original 30 participants to determine changes in land use and value after clearing had been completed. To inform the landowners they would be contacted during the next couple of months to arrange an interview, a pre-call letter (See Appendix A-1) was sent to each potential interviewee to provide general information about the project and the interviewer. The letter was sent ahead-of time in anticipation that it would increase the cooperation and response of the potential participant when they were called to set the interview date.

The first set of landowners was contacted approximately 1 week after the pre-call letters were sent. Calls were placed to the remaining participants throughout the summer to set-up interviews a few days to 1 week after the call was placed. Of the original 30 participants, only 23 had actually completed brush clearing work on their land at the time interviews were arranged. Interviews were scheduled at a time and place that

was most convenient for the participant. Most interviews took place at the landowner's home, or on the treatment property. A few of the interviews, however, were conducted at a local restaurant or at the participant's place of employment. The interviews generally lasted from 45 minutes to 1 hour, although a few took longer because the interviewee wanted to conduct a tour of their property and the treatment area.

A revised copy of the original questionnaire (See Appendix A-2), developed for the Phase 1 interviews, was used as the format for the Phase II portion. Questions ranged from topics concerning the enterprises and associated area on each property, to the identification of brush problem areas and the respective problem species. An aerial photograph and map of each landowner's property, prepared for the 2003 interviews, was used to identify the location of the brush problem areas and the dominant tree species found there, as well as mark the locale of springs and creeks found on the site. The interviewee went through all of the questions on the questionnaire and noted any changes from their pre-clearing 2003 answers that had occurred since clearing had been performed on their property. Interview participants were then asked to note on the property map the approximate boundaries of where juniper clearing had occurred. Changes in the canopy cover and dominant species were recorded for those areas. Notations were also made if the landowner had perceived any changes in water yield for creeks or springs located in or around the brush treatment sites.

A budget for the enterprises implemented on the different properties was also developed for each landowner in 2003. Enterprise budgets were prepared in 2003 by the Extension service for each of the different enterprise types in operation within the two counties, and are considered representative for the average returns and expenses incurred

by the enterprises (See Appendix A-3). These budgets were used as a guide to help interviewed landowners design their individual enterprise budgets if they were unsure of the value of a particular item. During the 2006 interviews, each of the landowner's enterprise budgets was examined and any changes in the expenses or revenues that were the result of clearing were recorded. Changes in enterprises not due to clearing were not recorded, as they were not the focus of this study. Due to an ongoing drought, landowners were sometimes asked to provide not only current activities, but also project future management practices, such as stocking rate changes, they planned to incorporate into their enterprises that could be attributed to brush clearing work. Basing their future enterprise changes on what they considered a "normal" year, it was anticipated that a more accurate depiction of the potential juniper clearing impacts could be portrayed in some circumstances.

Canopy Cover Change

Using the aerial photograph and map created for their property in 2003, landowners identified areas where brush clearing had been performed. Within the treatment areas, each individual identified tree species that now dominated the canopy cover post-juniper clearing. Average canopy cover percentage and tree size, was also estimated for these areas. With the aid of a canopy cover diagram (See Appendix A-4), landowners were asked to rank canopy cover at light (0-20%), moderate (20-35%), or heavy (> 35%). Tree size class categories ranged from small (< 76 mm Trunk Dia. and < 1.2 m Canopy Height), medium (76-152 mm Trunk Dia. and 1.2-3 m Canopy Height), or Large (> 152 mm trunk Dia. and > 3 m Canopy Height). The answers provided for brush characteristics of cleared areas in the 2003 interviews, were then compared with results

from these same areas after treatment. A spreadsheet was prepared to record results from each of these "brush units" for both 2003 and 2006. The total number of each canopy cover class and size class were determined to show differences between pre- and post-clearing. The differences in species canopy cover were also looked at and charts were prepared to identify dominant species in 2003 and 2006.

The canopy cover data was found not to be normally distributed after a normal Q-Q plot was performed. Pearson chi-square tests were used to test statistical differences due to clearing in canopy cover density as well as size class distribution. Pre-clearing data from 2003 and post-clearing data from 2006 represented the two categorical variables studied for both density and size class tests. Each variable was, in turn, divided into three potential categories landowners could give. The three divisions were identified as one, two, and three, representing light, moderate, and heavy respectively for canopy cover densities, and small, medium, and large for size class divisions. Because there were three divisions within each category, the Cramer's V test was used in place of the Phi test for measuring "strength of association between the two categorical variables" (Field 2000).

Stocking Rate

In 2003, each landowner was asked to identify the number of animals he/she was running on the designated property. From their answers, the total number of ha/au was determined. During the 2006 interviews, landowners repeated this question so a comparison could be made between pre- and post- clearing stocking rates. Due to an ongoing drought affecting the area, landowners were also asked to make a future projection on the maximum number of animal units they would feel comfortable running

on an "average" year, now that brush clearing had been completed. Landowners were asked to make future projections because at the time of the interview, a number of property owners had reduced their stock or were completely resting their pastures due to the drought. Because the intent of the project was to determine the effects of brush clearing alone, future estimates were thought to be the most easily measured way to factor out the role the 2006 drought may have played on current stocking rates. Comparisons between changes in landowner enterprises were based on changes in stocking rates and the impact this had on individual budgets for project participants. In addition to the number of animal units each landowner was currently running, interviewees were also asked to estimate changes in forage production on treatment areas. Interview participants indicated their results by stating a percentage they felt was average over the cleared areas.

After performing normal Q-Q plots on the collected data, it was found the data were not normally distributed. Due to small sample size, and non-normal distribution of data, the Wilcoxon Rank-Sum test was used to measure the statistical significance between changes in number of animal units run, livestock production, and stocking rates due to clearing. The Wilcoxon Rank-Sum test is "a nonparametric alternative to the two-sample t test" (Weisstein 2007).

Landowner Satisfaction

To test for a difference in cost-share program satisfaction between landowners who participated in the LRRP using EQIP funds or LRRP funds, an importance/performance matrix was constructed. Four factors that could influence a landowner's decision on whether they would participate in a cost-share program were

delineated. The four factors were: amount of cost-share support provided, length of the program contract, technical assistance provided, and amount of paperwork required. Landowners participating in the LRRP under one or both of the different cost-share programs, were asked to rank on a scale of 1 to 6 how important each of four factors were in their decision to participate. The scale went from 1 being "not important at all" to 6 being "extremely important." After determining their level of importance in the initial decision making process, participants were then asked to rank their satisfaction with these same four factors now that they had participated in the program. A scale of 1 to 6, with 1 being very poor, to 6 being excellent, was also used to determine the landowner's level of satisfaction. Due to low number of landowners interviewed in the initial interview process, extra landowners who had brush work performed on their property using EQIP or LRRP funds were identified and contacted. The Environmental Working Group's Farm Subsidy Database < http://www.ewg.org:16080/farm/region.php?fips=48000> was used to obtain names of extra EQIP participants. The names of these additional landowners were listed in a spreadsheet and their contact information was found in the white pages. Names and contact information for additional landowners participating in the LRRP under LRRP funds were obtained from one of the active managers involved with the project. No pre-clearing data was available for these extra participants, so only the landowner satisfaction questions from the questionnaire were asked. These condensed interviews were conducted over the phone and lasted approximately 5-10 minutes. Landowners participating under EQIP funds were asked which EQIP programs they had participated in, and only those who had juniper cleared were included in the study. Twenty extra landowners, 7 under LRRP funds and 13 under EQIP funds,

participated in the landowner satisfaction interviews. Including the 23 original interview participants, the total number of landowners interviewed for this portion of the study was forty-three43, with 22 receiving LRRP funds and 21 contracted through EQIP funds.

The Mann-Whitney U test was used to conduct statistical analyses on the importance-performance data. The Mann-Whitney U test is a non-parametric test used for "testing differences between means when two conditions and different subjects have been used in each condition" (Field 2000). Siegel and Castellan (1988) also describe the Mann-Whitney U test as a useful alternative to the parametric t test because it avoids the assumptions made by the t test and is also useful when the measurement in the research is weaker than interval scaling (Siegel and Castellan 1988). The two conditions analyzed in this study were LRRP contracted landowners and EQIP contracted landowners. Statistical differences between the 2 funding sources and their scores for importance and performance for each of the 4 factors mentioned above were analyzed. Mean scores for importance and performance were calculated for both LRRP and EQIP landowners for each of the 4 factors.

The Importance-Performance Analysis method demonstrated by Martilla and James (1977) was used to analyze the performance of the cost-share programs individually. For this method, two scatter plots were created, 1 representing LRRP information and 1 EQIP information. Data was collected based on a scale of 1 to 6, making 3.5 the neutral score. An importance score of 4 or higher represented a factor that landowners considered to be an important determinant in whether they would have participated in the cost-share program. A score of 3 or lower, on the other hand, represented a factor they felt to be of little importance in their overall decision on

participating in the program. For descriptive purposes, scores of 4 or higher will hereafter be referred to as "positive" scores, while scores of 3 or lower will be referred to as "negative" scores, representing a positive or negative attitude towards what is being described. Positive scores on the performance scale represented satisfaction with the selected factor, while negative scores were representative of dissatisfaction for the particular factor. The x- and y- axes for each scatter plot were moved to 3.5 so 4 different quadrants were created, representing divisions of positive and negative scores. Mean scores of importance (y-axis) were plotted against mean scores of performance (x-axis) for each of the four factors, as well as combined score means on both graphs. A combined average for all 4 factors, representing overall satisfaction for each program, was also considered. Although no resources collected on this analysis method suggested a combined average could be used, it was considered logical by those in this study since all 4 factors influenced landowner decisions and overall satisfaction. Each of the 4 factors, along with the combined average for all, fell into 1 of 4 categories upon being plotted on the scatter graph. The four divisions, defined by Martilla and James (1977), are; "Keep up the Good Work," "Concentrate Here," "Low Priority," and "Possible Overkill." A factor with positive scores for both importance and performance falls into the "Keep up the Good Work" quadrant. This quadrant represents factors the landowner considers important in their decision-making process, and after participating in the program, they were also satisfied with its performance. The "Concentrate Here" quadrant represents those factors a landowner considered important, but were not satisfied with the results. Factors with a positive importance score and a negative performance score fall into this category and represent those areas the program managers may want to

concentrate on if they are going to improve participant satisfaction. Factors scoring negative scores for both importance and performance are considered "Low Priority." Factors in this category are considered of low importance in their decision-making process and are therefore a low priority when looking at performance scores. The final quadrant, "Possible Overkill," represents factors with a negative importance score and a positive performance score. Factors in this category may represent areas where the program is contributing more resources than necessary, since the factor is considered to be of low importance. Gap scores were also calculated for each factor by subtracting the mean importance score from the mean performance score (Payne 2002) to further illustrate where improvements may be needed.

CHAPTER IV

RESULTS

Twenty-three of the original 30 landowners participated in the second, post-clearing interviews conducted for the economic portion of the LRRP. For purposes of comparison, Phase I data was omitted from the original results for the 7 landowners who did not participate in the Phase II interview process. The following results, therefore, include only data collected from the 23 individuals who were participants in both pre- and post-clearing interviews. Results also indicate only the changes that were a direct result of juniper clearing activities, as changes due to year, weather, market, management, or other outside factors were beyond the focus of this study. Results collected from 2003 were considered the same in 2006, if factors other than brush clearing were responsible for the change. Due to an ongoing drought, a number of landowners were deferring their property from livestock grazing, or had reduced their stocking rates. To try and mitigate this factor, landowners were asked to estimate future changes in stocking rates, land use, etc, they would expect to implement in a "normal" year following the brush management work. Current information and future predictions are both listed as results for 2006, the year data was collected.

General Landowner Information

Twenty-three landowners, representing approximately 5,656 hectares (14,000 acres) of land within the project area, were interviewed during the Phase II economic portion of the LRRP study. Five women, 2 under LRRP contracts and 3 under EQIP contracts, and 18 men, 13 using LRRP funds and 5 using EQIP funds, were represented in the study. Ages of LRRP property managers ranged from 32 to 78, with a mean age of

56 and median age of 60. Ages of EQIP property managers ranged from 27 to 94, with a mean age of 59 and a median age of 57. The mean years of farming or ranching experience for LRRP and EQIP participants was 30 and 24 respectively. Ninety-five percent of the 23 landowners interviewed indicated they received 30% or less of their income from activities implemented on their land, with 43% of those landowners receiving 5% or less. Over 90% of the land represented in this study was considered native pasture, with improved pasture and cropland making up the remaining land type (Fig. 3).

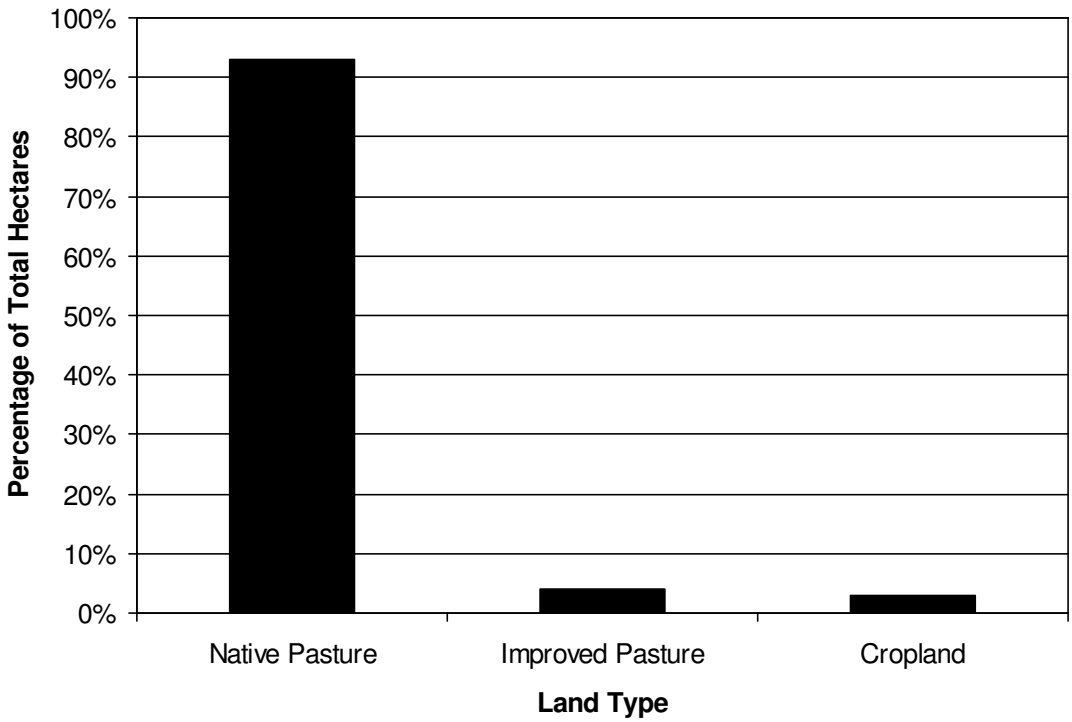

Figure 3. Percentage distribution of land types represented by the LRRP interview participants.

The 5,656 ha (14,000 ac) study area was divided into 27 recognizable management units, defined by Jones and Conner (2004) as "a unit of land impacted by a unique set of management decisions made by a single producer or a group of individuals." Several ranches in this study were considered one management unit, as they were operated under the same manager and set of management decisions. The management units ranged in size from approximately 24 to 1,092 ha (60 to 2700 ac) (Fig. 4), with an average and median size of 206 and 123 ha (510 and 304 ac) respectively (Table 2). The management units were further divided into 80 pastures, with approximately 35% of the total land area within those management units having only one pasture (Fig. 5). Jones and Conner (2004) define a pasture as a "fenced off unit within the management unit that can deter livestock and support rotational grazing." The pastures ranged in size from approximately 16 to 655 ha (40 to 1618 ac) (Fig. 6), with an average and median size of 68 and 36 ha (169 and 89 ac) respectively (Table 3). The standard deviation shown in Table 1 reflects the high degree of variability in size for both the management units and pastures. Figures 2 and 4 also show the size distribution in acres for the management units and pastures. No changes were observed from 2003 to 2006 regarding the number or size of management units or pastures. The total area operated by the landowners averaged 254 ha (629 ac), with a median size of 154 ha (381 ac). The high standard deviation, 266 ha (658 ac), represents the high variability in size for the total hectares operated by the different participants.

Table 2. Ranch, management unit and pasture size statistics for LRRP participants.

	Total Count	Mean Size (ha)	Standard Deviation (ha)	Median Size (ha)
Ranch	23	254	266	154
Management Units	27	207	231	123
Pastures	80	68	89	36

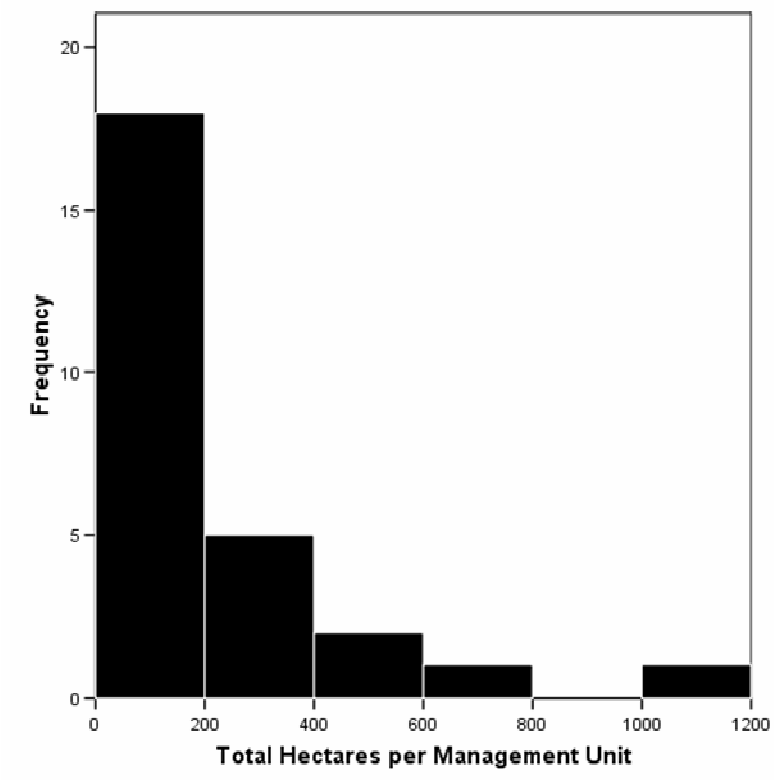

Figure 4. Size distribution for management units represented by LRRP participants.

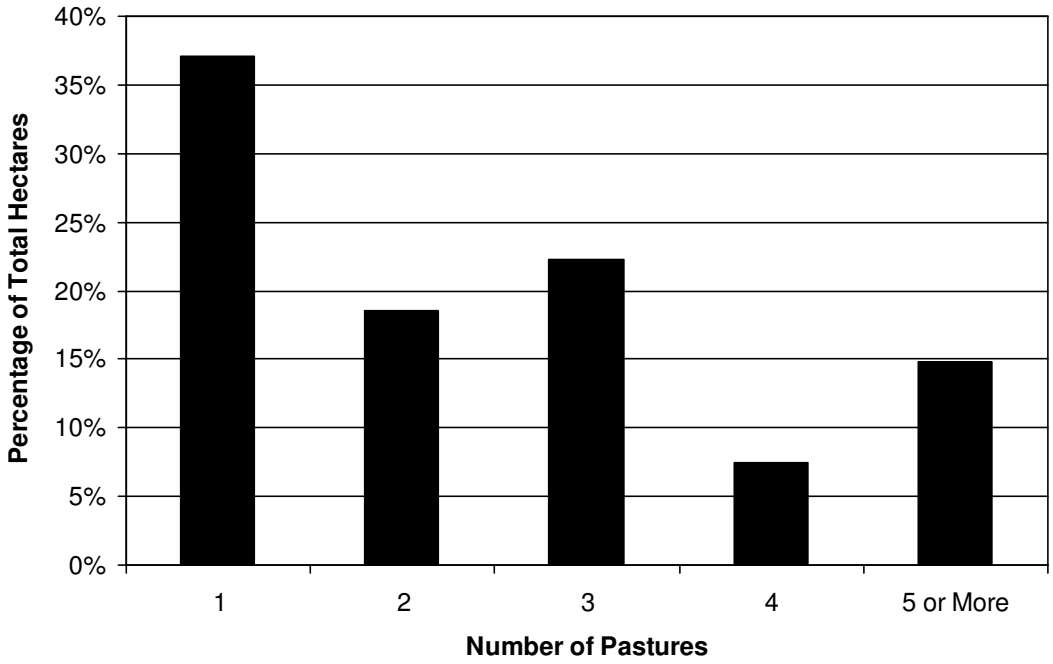

Figure 5. Percentage of total area represented in the LRRP by the number of pastures per management unit.

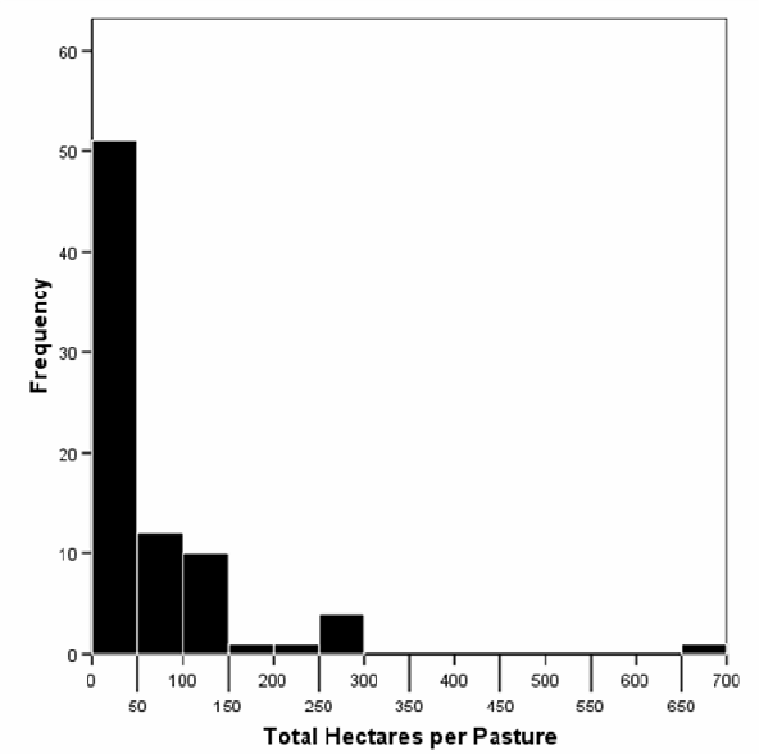

Figure 6. Distribution for pasture size (ha) represented by LRRP participants.

Clearing Information

The average number of hectares cleared was estimated for each cost-share program. LRRP participants showed less variation in the number of hectares cleared than EQIP participants, as shown by the lower standard deviation. The mean and median amount of hectares cleared was also shown to be higher for participants in the EQIP program than the LRRP program. Table 3 represents the clearing data for participating landowners.

Table 3. Average area cleared (ha) for LRRP participants. Table represents the differences in amount of area cleared between landowners contracted under LRRP funds and those with EQIP contracts.

	No. of Participants	Minimum (ha)	Maximum (ha)	Mean (ha)	Median (ha)	Standard Deviation (ha)
LRRP	15	15	79	37	30	17
EQIP	8	6	449	122	89	144

Enterprise Results

Small changes were recognized in relation to land use between 2003 and 2006 (Fig. 7). Land use devoted to livestock production alone, whether operated by the individual landowner or leased for grazing, accounted for the majority of land utilization at over 50% both years. However, a slight increase was shown as individuals began incorporating previously rested land into the grazing regime. Land utilized for hunting alone showed a slight decrease as landowners implemented some form of grazing practice into the pattern, thereby increasing land supporting both livestock and hunting enterprises. The amount of rested land decreased from 5 to 2% as brush work allowed land previously infested with juniper to become useable again. Land devoted to cropland showed no change and accounted for only 3% of the total land use (Fig. 7).

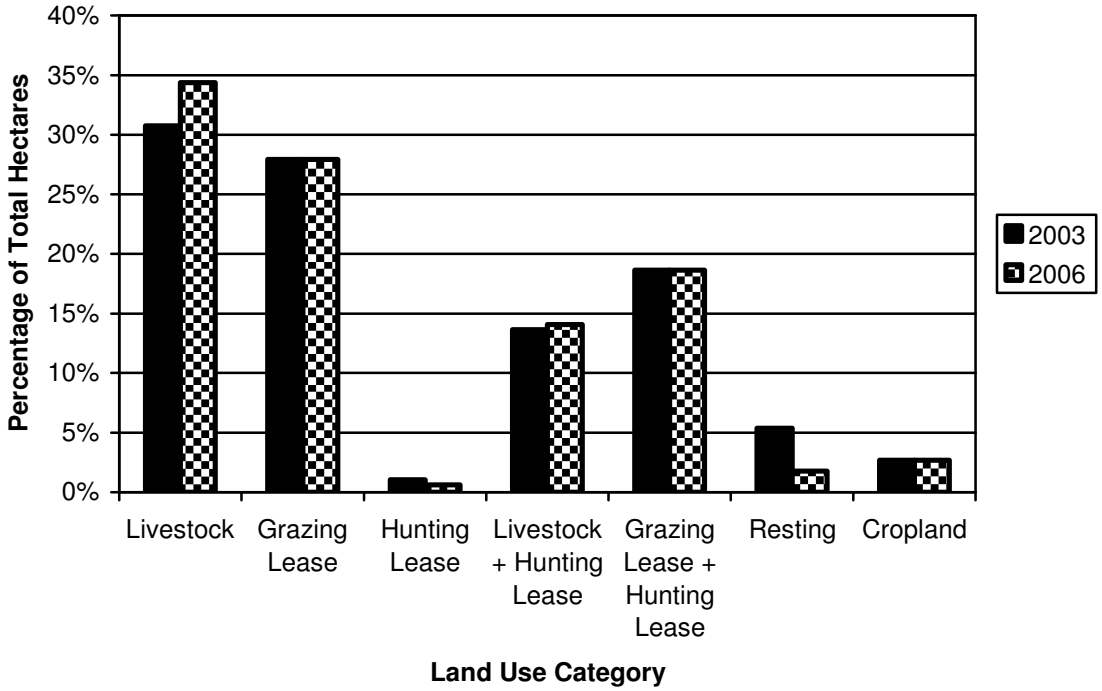

Figure 7. Percentage of total area for each land use category represented by the LRRP.

Livestock Species

Livestock production increased from 92 to 96% in land use from 2003 to 2006. Cattle were the primary enterprise each year, increasing in hectares from 84 to 85% following brushwork. Land devoted to both cattle and goat production accounted for 4 and 7% of land use in 2003 and 2006 respectively, while goats alone were only responsible for 3% of the total hectares both years. Sheep utilized only 1% of the land represented within the study area both years, while land not supporting any type of livestock was reduced from 9 to approximately 4% following juniper removal (Fig. 8).

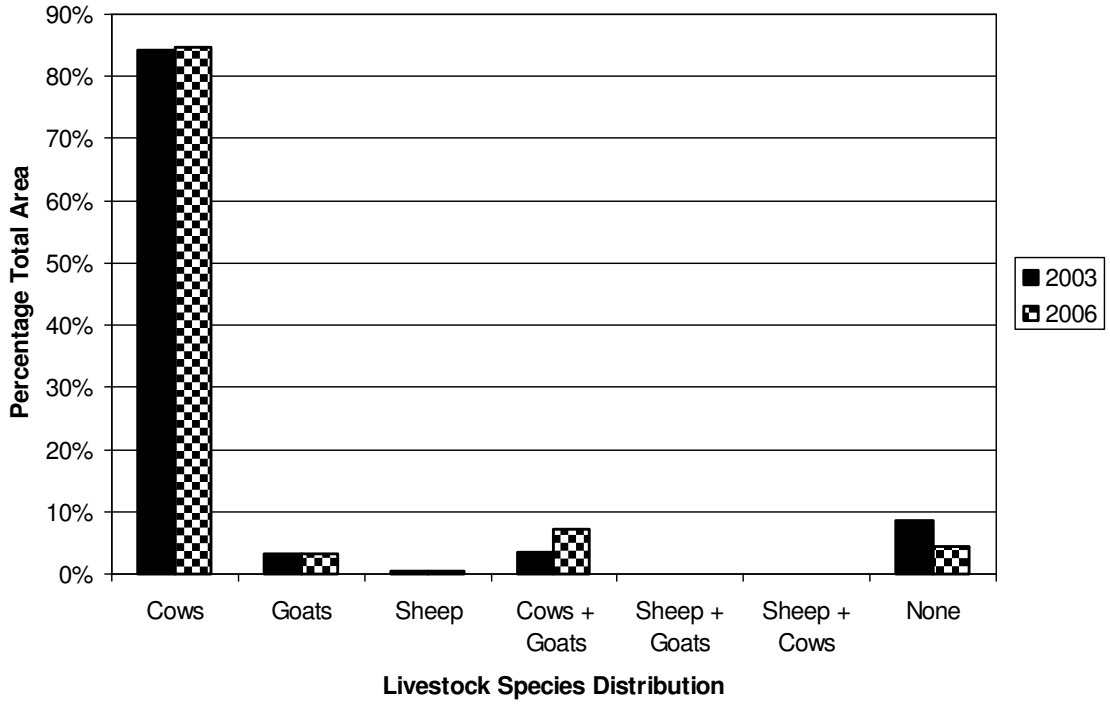

Figure 8. Percentage of total area represented by each livestock enterprise recognized in this study.

Dominant Brush Cover Species

Eighty-two brush units, representing 46 pastures within the 27 management units, were affected by juniper clearing activities. Brush units were identified by the landowners in the 2003 interviews. Prior to brush removal, approximately 70% of the canopy cover located within these brush units was listed as heavy (> 35%), while less than 10% was listed in the light (0-20%) canopy cover class (Fig. 9). Following juniper removal, approximately 85% of the brush units were observed to have light to medium (20-35%) canopy cover, with only 15% remaining in the heavy coverage class (Fig. 9). Tree size also shifted as the majority of trees fell into the medium (4'-10' Canopy Height) and large (> 10') size classes, 40% and 44% respectively, prior to brush removal. Post-removal observations showed the dominance of trees falling into the large size class,

representing approximately 75% of the total observed trees found within these treatment areas (Fig. 9). The changes in canopy cover and size class distribution were found to be significantly different following juniper removal. The Cramer's V score of 0.633 for the canopy cover changes represents a relatively high level of strength of association between the density of canopy cover and juniper clearing activities, while the value of 0.334 for changes in size class represents only a medium level of strength between clearing and size class.

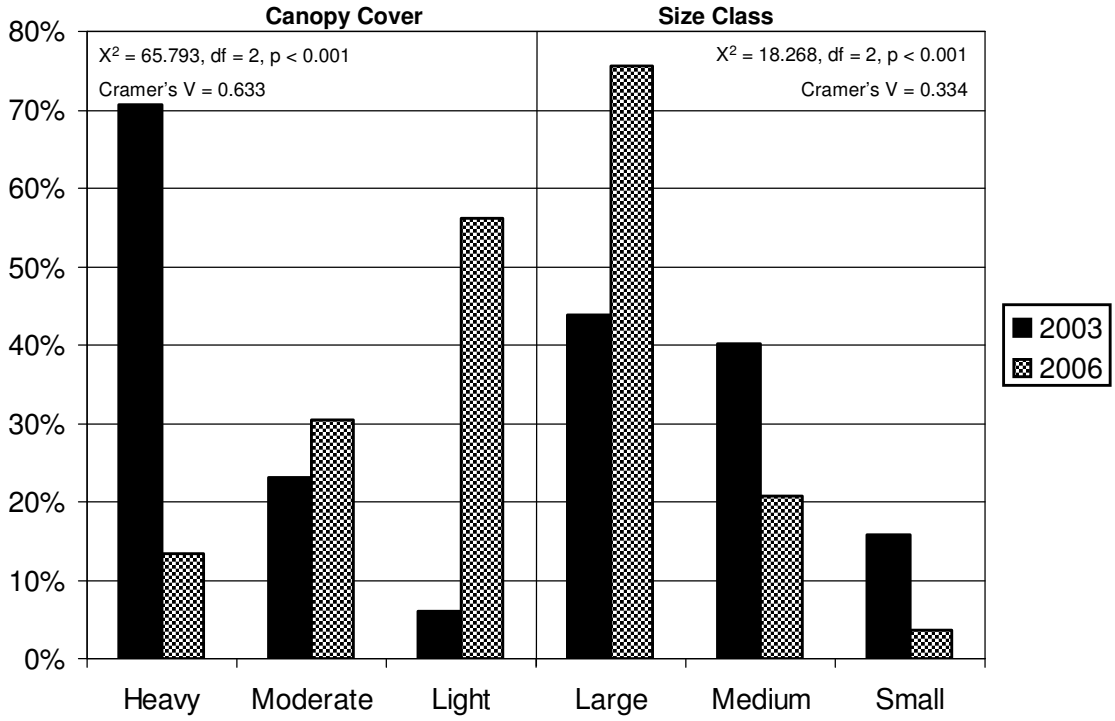

Figure 9. Canopy cover and size class changes observed on the 82 brush units where juniper was cleared.

Clearing activities also caused changes in species dominance within the brush units. Ashe juniper was found to be the dominant tree species, accounting for over 70% of the species coverage, prior to brush clearing efforts (Fig. 10). Following juniper

removal, live oaks, post oaks, and elms occupied the highest percentage of coverage at 43%, 14%, and 13% respectively, while juniper cover was reduced to less than 2% (Fig. 11). Brush clearing allowed a much more diverse selection of woody species to gain dominance in the canopy cover when the junipers were removed.

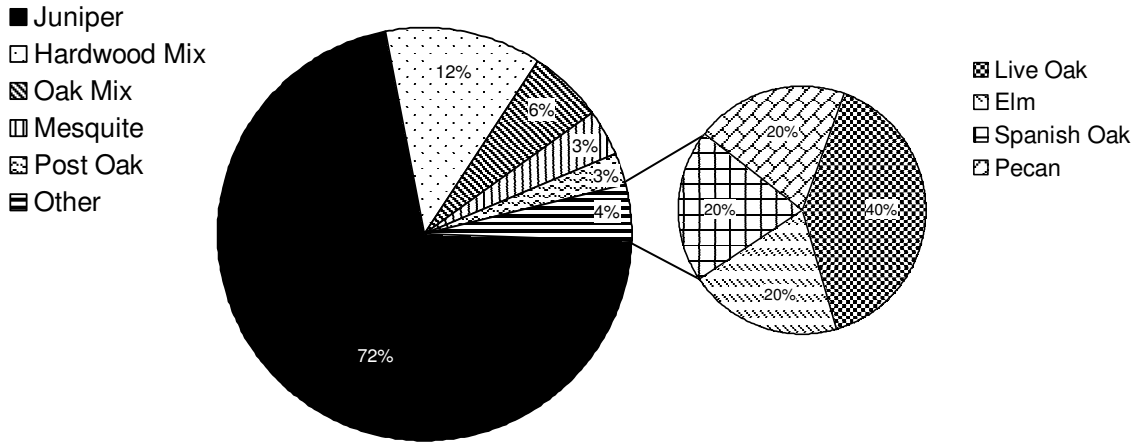

Figure 10. Dominant woody species present in project brush units in 2003 prior to juniper clearing activities.

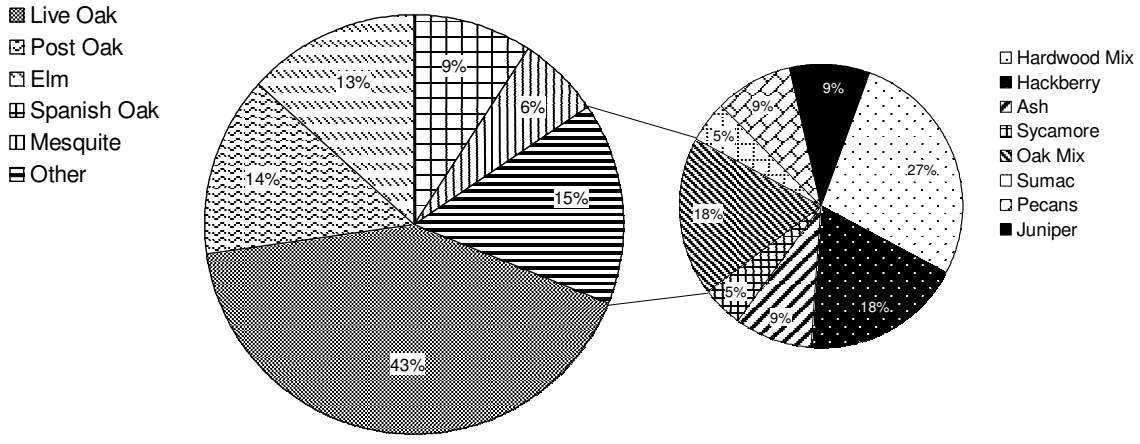

Figure 11. Dominant woody species present in project brush units in 2006 following juniper clearing activities.

Forage Production

Forage production increased on 80 out of 82 brush units located within 46 of the 80 pastures in the study area following juniper removal. Of the remaining 2 brush units, 1 landowner reported seeing no increase in forage production, while the other landowner had no comment. The average forage increase was 21%, ranging from 5-100%, with a median increase of 15% (Fig. 12).

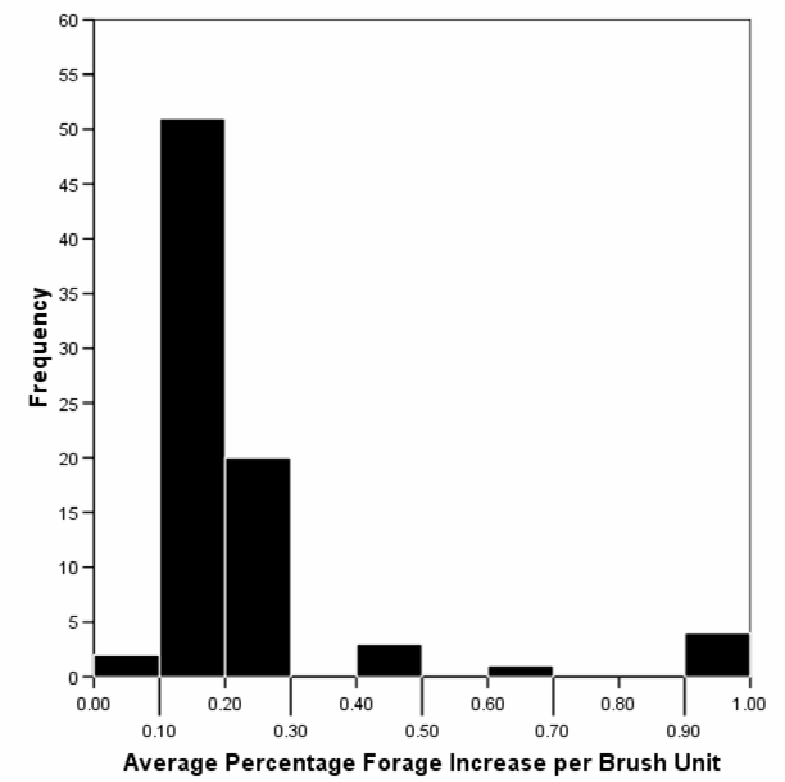

Figure 12. Distribution of average forage production increase per brush unit following juniper removal.

Stocking Rate

As forage production increased, the number of hectares required per animal unit (ha/au) showed a general decrease following brushwork. Heitschmidt and Taylor (2003) define an animal unit as "any specified combination of animals with a total forage demand of 12 kg of dry matter per day." A 453.59 kg (1000 lb) cow with her calf is the standard animal unit reference. Of the 19 individually managed livestock enterprises represented in this study, 74% showed an increase in their herd stocking rates and a decrease in the ha/au. Prior to juniper removal, 8 ha/au was the average when all enterprises were combined. The 2006 interviews showed a 2 ha reduction, bringing the new average to 6 ha/au (Fig. 13). The average increase for animal units run on the treated property was 23 before juniper was removed and 31 after brush treatment for the combined enterprises (Fig. 14). Changes in the number of animal units run and the amount of ha/au required following juniper removal were found to be significantly different following juniper clearing. The change in average livestock production per management unit following brush control efforts was also found to be significantly different. Livestock production increased from approximately 33 kg/ha (30 lbs/ac) in 2003 to 47 kg/ha (42 lbs/ac) in 2006 (Fig. 15), accounting for a p-value of 0.05. Figures 16 and 17 demonstrate the distributions in production (kg/ha) for 2003 and 2006 respectively.

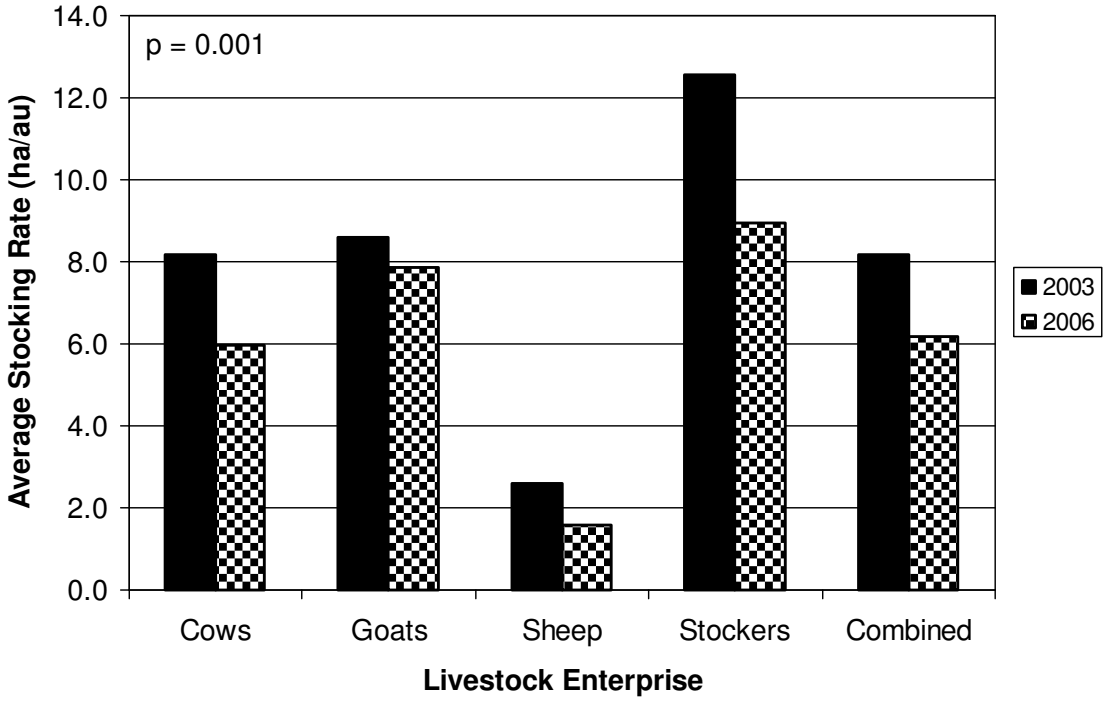

Figure 13. Average stocking rate (ha/au) for each individual enterprise and combined enterprise averages.

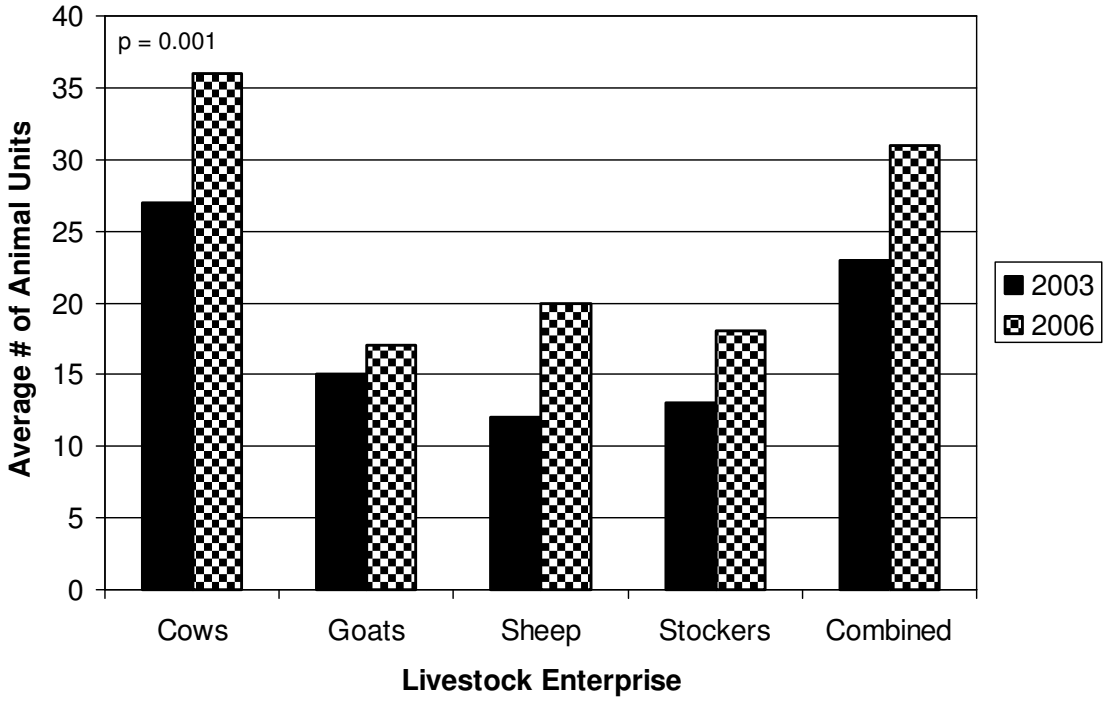

Figure 14. Average number of animal units (by species and combined) run by landowners before and after juniper removal.

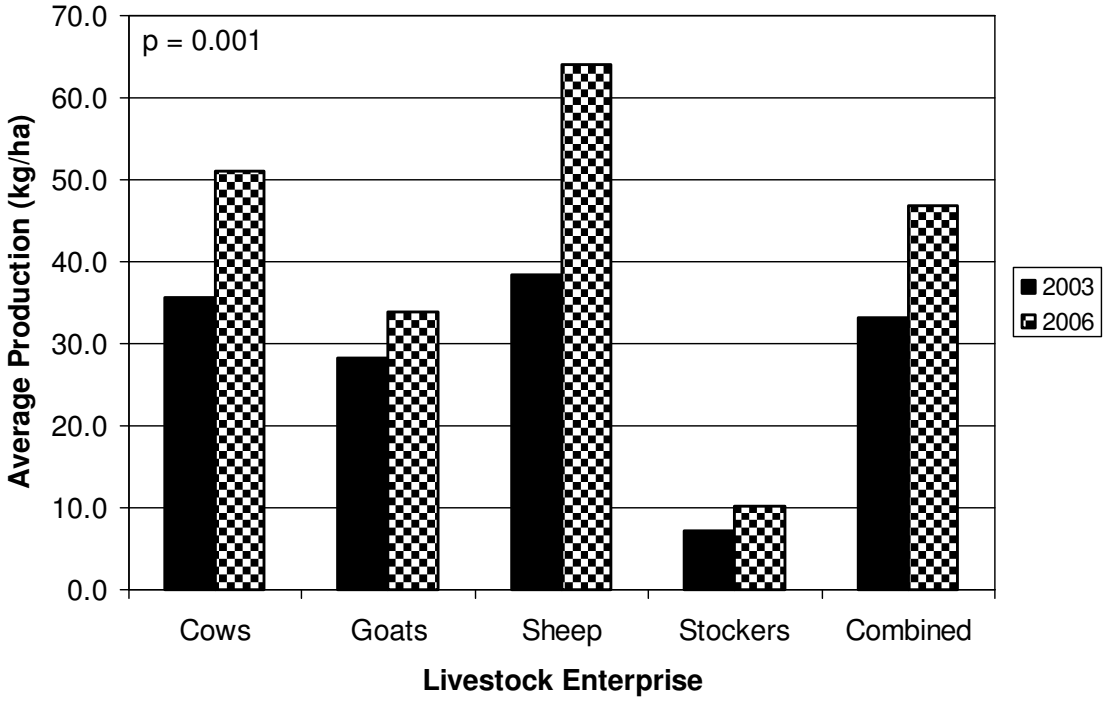

Figure 15. Average livestock production (kg/ha) on treated areas before and after juniper removal.

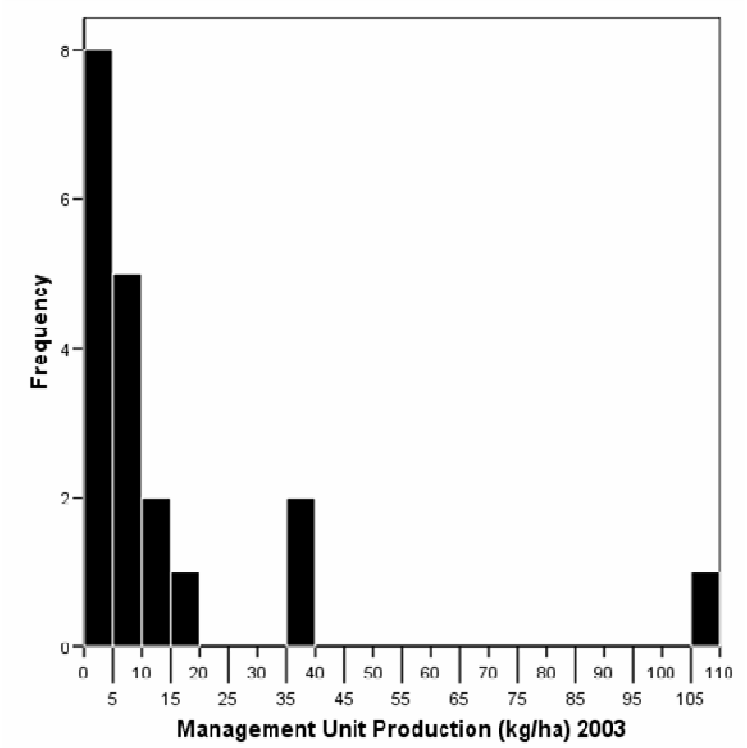

Figure 16. Distribution of average production (kg/ha) per management unit in 2003 prior to juniper removal.

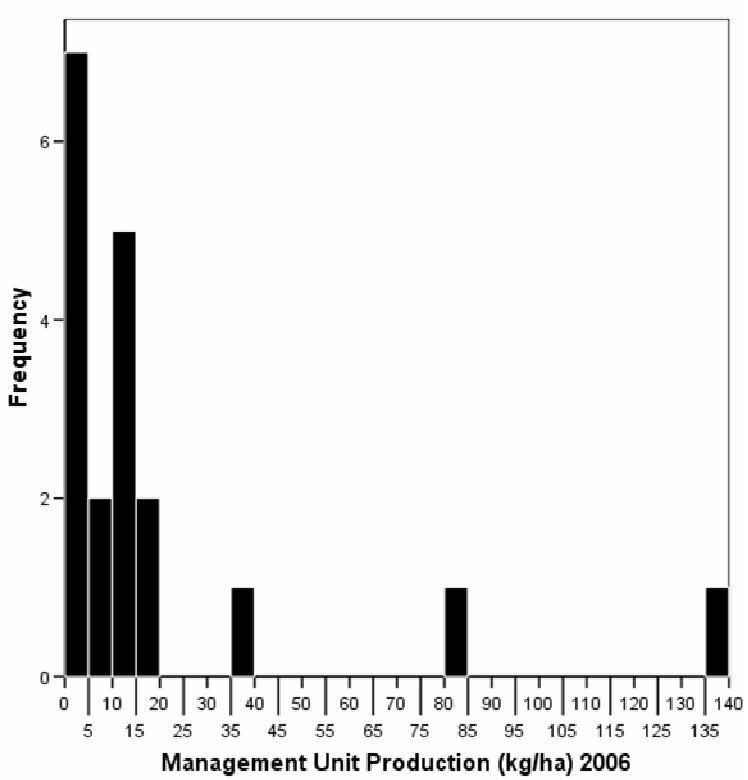

Figure 17. Distribution of average production (kg/ha) per management unit in 2006 following juniper removal.

Enterprise Net Returns

Changes in the annual net returns per hectare were found to be significantly different ($p = 0.001$) for the combined individually operated livestock enterprises following juniper removal. The individually operated livestock enterprises recognized an average increase of $12.00/ha in annual net returns following brush treatment. Net returns in 2003 were approximately $41.00/ha, while post-clearing net returns were approximately $53.00/ha. Land leased for hunting and grazing alone showed no change in net returns from 2003 to 2006, with an average value of $23.00/ha and $28.00/ha respectively (Fig. 18). All property managers who leased land in this study reported their intent to keep leasing rates the same, even with brush clearing completed. Thirteen

landowners utilized hunting leases as a second enterprise on land already supporting a livestock enterprise. The hunting leases, when used as a second enterprise, caused a significant increase ($p = 0.001$) in the annual net returns, at an average increase of $22.20 per hectare, bringing the average net returns from $30.00/ha to $41.00/ha when hunting leases were used as a second enterprise.

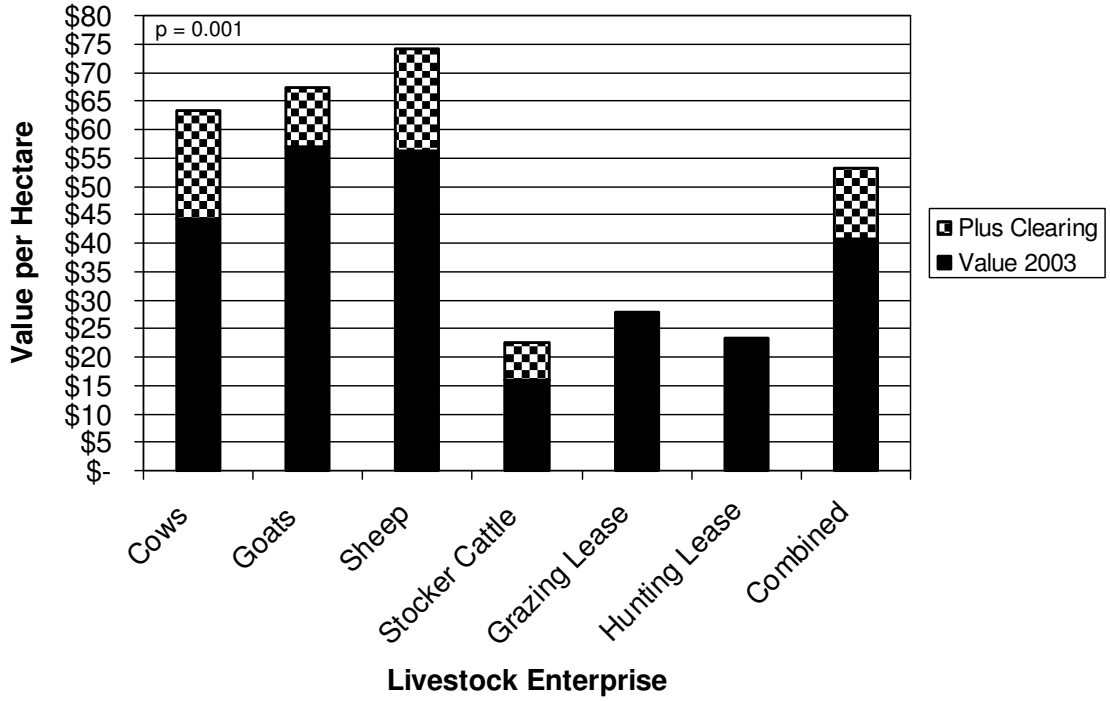

Figure 18. Average net returns per hectare for each enterprise and combined in 2006, following juniper removal.

Landowner Satisfaction

Forty-three landowners, 22 contracted under LRRP funding sources and 21 contracted under EQIP funds, were interviewed for the landowner satisfaction portion of the study. Four women and 18 men contracted under LRRP funds were interviewed for this portion of the study, while 3 women and 18 men under EQIP contracts were also

interviewed. The average age for LRRP and EQIP participants interviewed was 61 and 60 respectively. The average number of years of farming or ranching experience recognized by these property managers was 22 and 31 years for LRRP and EQIP contracted landowners respectively. The amount of cost-share support provided, contract length, technical assistance provided, and the amount of paperwork were identified as 4 factors which may have influenced a landowner's decision to participate in one or both of the cost-share programs observed in this study. Significant differences in satisfaction were found between the participants in terms of the cost-share support provided and the amount of bureaucratic paperwork required to be filled out. The other 2 factors, contract length and technical assistance provided, showed no significant difference between the 2 programs. When all 4 factors were combined, a significant difference was found between the 2 groups in terms of performance; however, they were not significantly different according to the importance they placed on the combined factors. No significant differences were found between the 2 groups in terms of the importance participants placed on the 4 tested factors.

The average importance scores were graphed on a scatter plot against the respective performance scores for each of the 4 factors as well as their combined scores. Each factor fell into 1 of 4 quadrants: Keep up the Good work representing factors landowners consider important when determining whether to participate in the LRRP, and are satisfied with results following juniper control efforts; Concentrate Here representing factors landowners consider important, but are not satisfied with results; Low Priority representing factors landowners do not consider important, and are not satisfied with results; and Possible Overkill representing factors landowners are satisfied

with performance, but do not find important. Factors considered important, are those program managers may be most interested in focusing efforts and resources on to keep landowners satisfied. Factors considered low in importance may represent areas where managers can shift attention and resources from to improve satisfaction to factors of high importance. It was found that all factors, for both programs, fell into the "Keep up the Good Work" or "Possible Overkill" categories (Fig. 19 and 20).

Tables 4 and 5 show the mean values for each factor in terms of importance and performance, as well as the gap score between the mean importance and performance values. Gap score indicates difference between performance and importance scores. Positive gap scores indicate factors where performance is rated higher than actual importance of factor. Negative gap scores indicate factors where performance is rated lower than factor importance, which may indicate areas where improvement is needed (Payne 2002). Only 1 LRRP factor showed a negative gap score, cost-share support received (Table 4). Although a negative gap score was recognized, the mean performance score was above 5, indicating overall satisfaction with the amount of cost-share support. Two factors scored negative gap scores for the EQIP funded landowners (Table 5). Those factors were cost-share support (-0.91) and technical assistance received (-0.05). While both factors fell in the "Keep up the Good Work" quadrant on the matrix grid (Fig. 19), the cost-share gap score indicates a possible area of concern. With a mean score of 3.90, the score falls in between an unsatisfied score of 3 and a satisfied score of 4, showing overall satisfaction is on the border of being unhappy with the amount of cost-share support received. The mean score for technical assistance, however, is 4.38, indicating overall satisfaction with the program and the assistance

provided by it. The gap score is also very low (0.05), so a strong difference between importance and satisfaction was not observed. When all factors were combined, mean scores indicated positive gap scores for both the LRRP funded participants and the EQIP funded landowners. Both programs fell in the "Keep up the Good Work" quadrant, indicating overall satisfaction with the programs when all factors were considered. Figures 21 and 22 depict the mean scores and standard deviation measurements for importance and performance scores, for the 4 factors for both LRRP and EQIP participants.

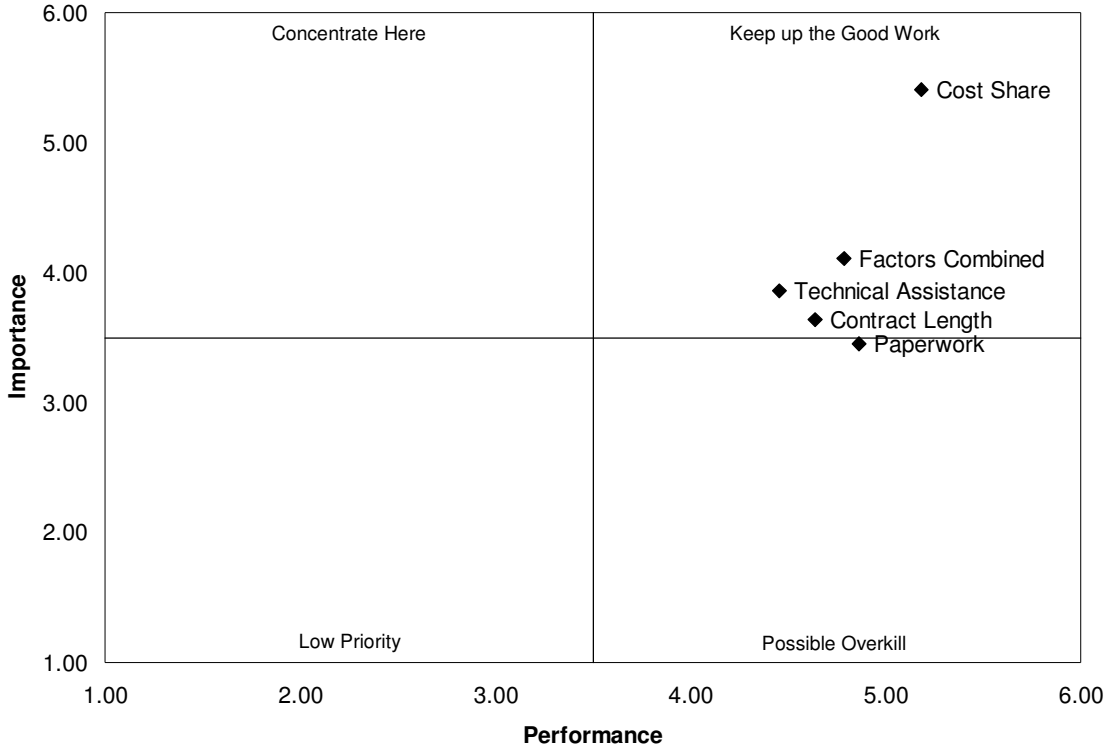

Figure 19. LRRP participants average importance scores plotted against average performance scores for each of 4 factors and combined averages for all factors.

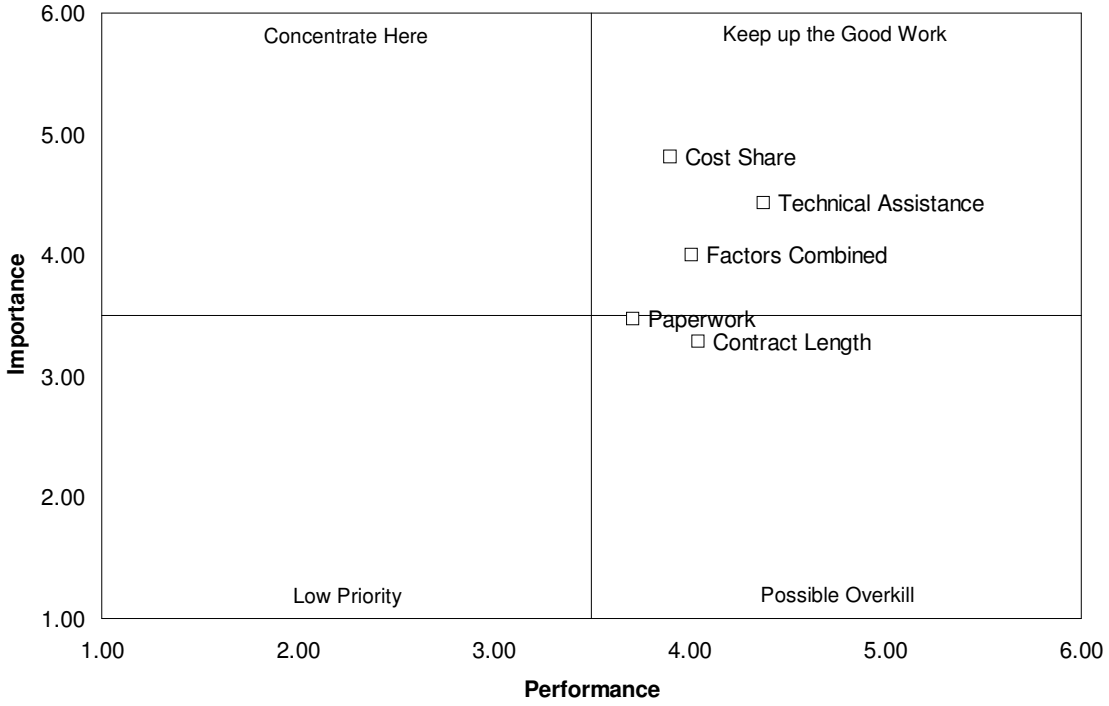

Figure 20. EQIP participants average importance scores plotted against average performance scores for each of 4 factors and combined averages for all factors.

Table 4. Mean and gap scores for four tested program factors and combined factor scores for LRRP participants.

Variable	Importance Mean	Performance Mean	Gap Score
Cost Share	5.41	5.18	-0.23
Contract Length	3.64	4.64	+1.00
Technical Assistance	3.86	4.45	+0.59
Paperwork	3.45	4.86	+1.41
Combined Factors	4.09	4.78	+0.69

Table 5. Mean and gap scores for four tested program factors and combined factor scores for EQIP participants.

Variable	Importance Mean	Performance Mean	Gap Score
Cost Share	4.81	3.90	-0.91
Contract Length	3.29	4.05	+0.76
Technical Assistance	4.43	4.38	-0.05
Paperwork	3.48	3.71	+0.23
Combined Factors	4.00	4.01	+0.01

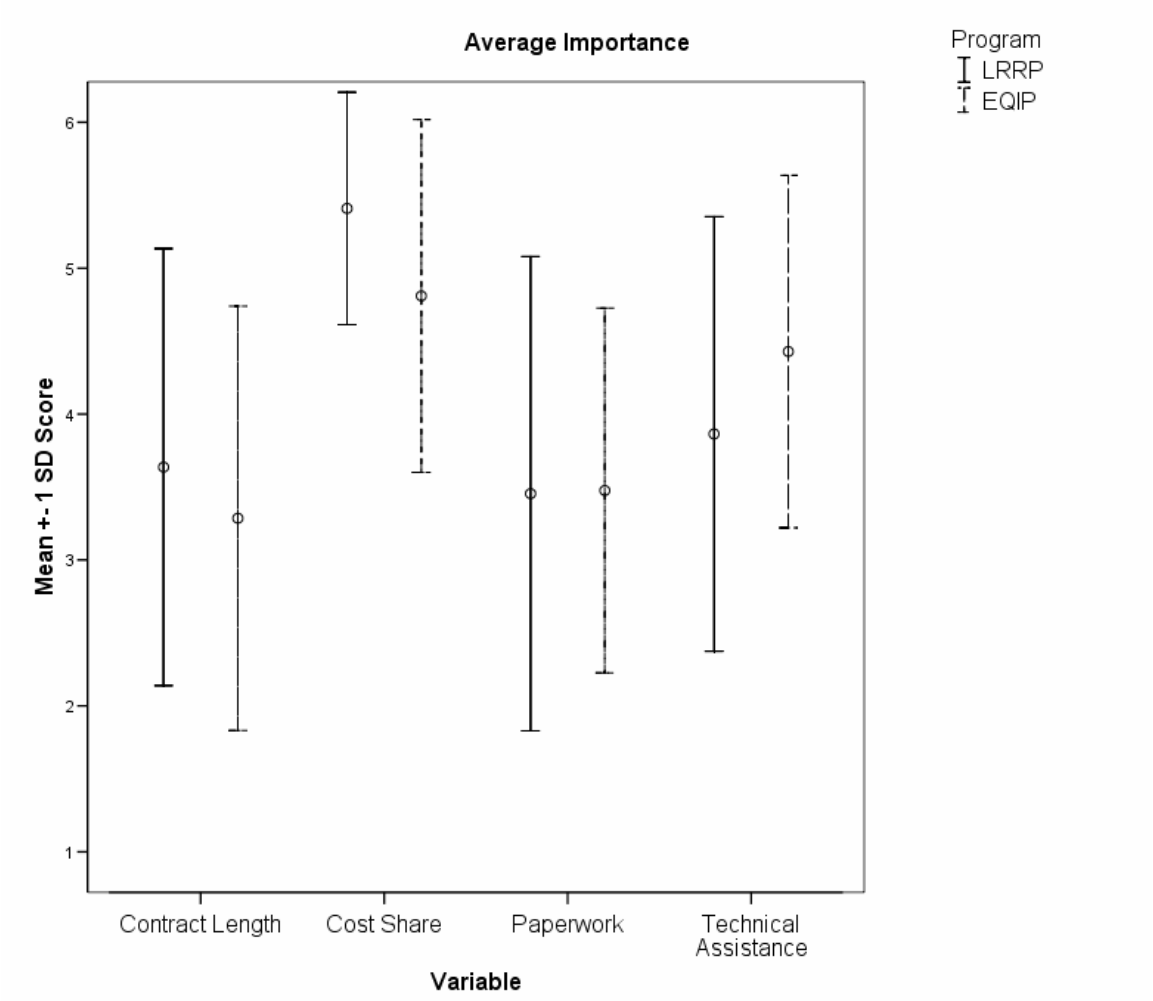

Figure 21. Mean importance scores and standard deviation measurements by factor for LRRP and EQIP participant responses.

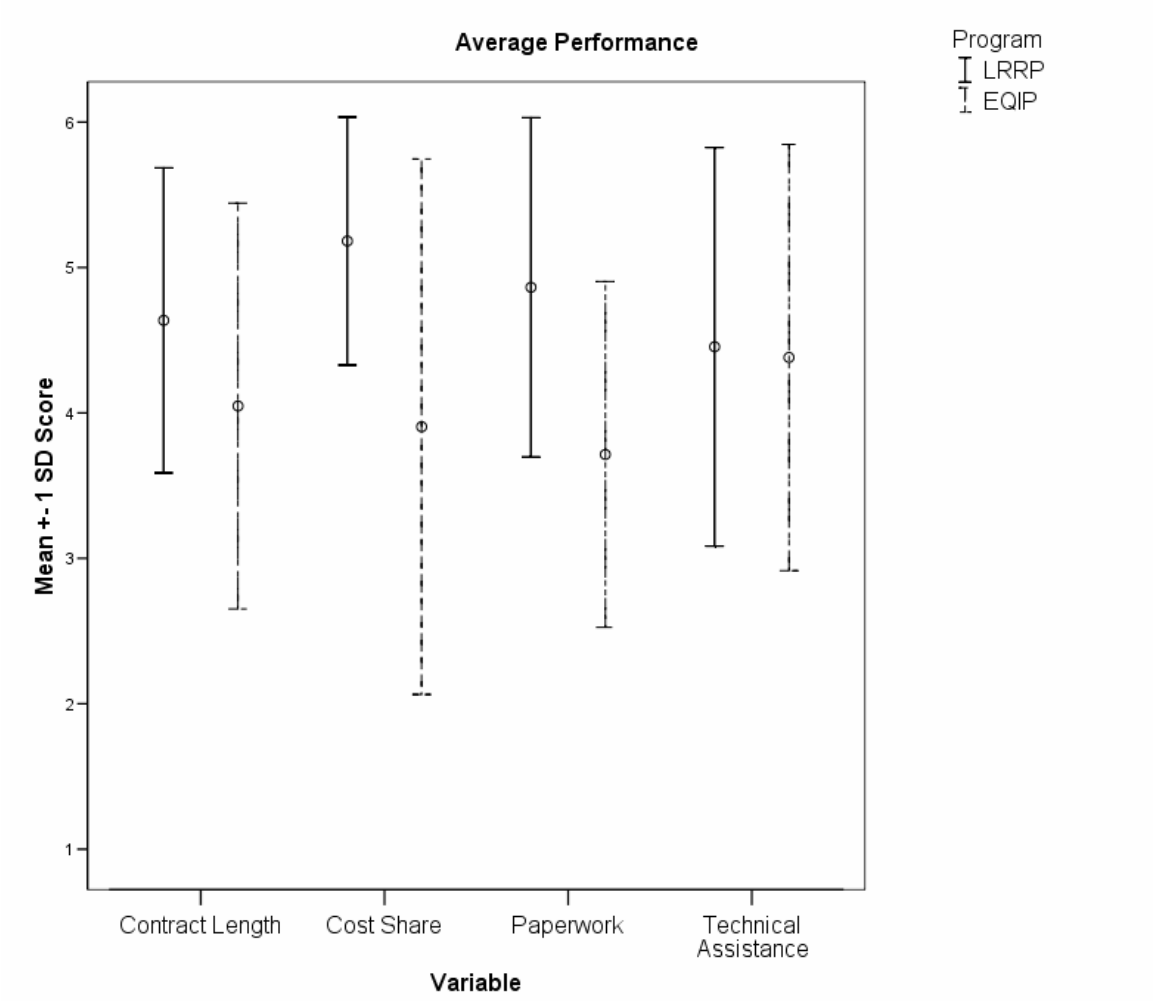

Figure 22. Mean performance scores and standard deviation of measurements by factor for LRRP and EQIP participant responses.

Landowner Comments

Following the structured portion of the interview, landowners were asked to provide any additional comments they had about the program they were contracted under. Most landowners contracted for clearing under LRRP funds indicated they were very satisfied with the overall program. Many considered it to be a very cost effective option for managing juniper and were not sure how they would have been able to do the clearing without the program. The availability of personnel was said to be sufficient for being

around to answer questions and the personnel did everything they said they were going to do. Others considered the program to be a positive conservation effort for improving water and forage quality. One of the most commonly heard complaints with the program concerned the brush piles that were left stacked or scattered across cleared areas. Although prescribed burns are scheduled to be conducted, many landowners were unsure as to when they would be implemented, and were anxious to have the brush piles removed from their property. A few other landowners indicated better monitoring, communication, and follow-up might be necessary to ensure the program is run as smoothly and efficiently as possible. Most landowners stated they were very satisfied with the clearing efforts and wished they could have had more property cleared.

Many landowners contracted under EQIP funds indicated they were very satisfied with the program and their results. Several have observed increased water yields following juniper removal and that their springs and creeks are running longer than previous years, despite the drought. Another property manager indicated the schedule created with the program helped keep them on track and that they couldn't have done the clearing without the contract. The sharing of knowledge was also considered a benefit of the program. Although a few participants considered the program economically feasible with government help and thought ranchers anywhere could afford to participate if they so chose, several others stated that without a second income, they would not have been able to complete their contract. These landowners indicated the "limitations and restrictions" associated with the program did not allow room for changes in clearing prices. Once they signed up for the contract, they were locked into the average clearing price calculated for that year. Although clearing prices rose in the years following (See

Appendix A-5, 6), they continued to receive the same amount of cost-share support as the year they signed up. The landowners were then responsible for paying the difference in cost and faced a fine if they decided to end their contract early. These landowners suggested that potential participants, and perhaps department personnel, needed to be better informed and educated about the regulations associated with the program. A few landowners indicated an increase in personnel would have helped, as they found it difficult to reach someone if they had questions. Changes in personnel caused problems for a few participants as the change occurred in the middle of their contract and affected the acreage they thought they were signed up to have cleared. A couple of landowners suggested a mesquite clearing program, or other understory brush control program, was necessary following juniper removal. A few other landowners talked about problems with their independently chosen contractors and concerns with the restrictions the Endangered Species Act placed on their clearing schedule and contracts. Comments offered by EQIP participants were split between positive and negative experiences. Many indicated their satisfaction with the program and would do it again, while others were dissatisfied and thought the program needed a little more flexibility.

CHAPTER V

DISCUSSION/CONCLUSIONS

Ashe Juniper represents a major monetary draw to the Texas economy, both in terms of losses associated with its growth and the costs of control efforts. Although native to Texas, Ashe juniper has increased its density and distribution across the landscape in the past 150 years since European settlement (Bray 1904, Fuhlendorf et al. 1996, Jackson and Van Auken 1997, Rasmussen and Wright 1989, Smeins 1980). Reduced fire frequency and increased grazing pressure from non-native livestock species are two factors most commonly attributed to this increased distribution (Allred 1949, Smeins 1980, Smeins 1983, Fuhlendorf et al. 1996). Chapter II of this report lists several other factors attributed to the increased spread of this species. Landowners facing a brush problem may find themselves in a struggle to determine the best option for their enterprises on their property. Allowing juniper to remain on the land can cause future problems as canopy cover increases, thereby increasing shading which can lead to forage reductions and lower water yields. This in turn can cause stocking rate reductions, and possibly lead to lowered production levels, animal health, and increased costs associated with the ease and handling of the livestock. Implementing control efforts to reduce canopy cover densities, however, is costly and many landowners cannot afford to exercise these practices on their property, leaving their best control option as leaving the land as is and doing nothing at all (Figure 2). It is generally recognized that the incorporation of a brush control program is a long-term investment, often requiring a large monetary investment before work is even performed, and benefits often extending several years into the future (Vantassel and Conner 1986). Even after benefits are

recognized, they still may not be enough to pay for clearing and maintenance activities once completed. Cost-share programs have helped landowners alleviate some of the expenses associated with brush clearing.

Dominant Brush Cover Species

Clearing activities caused a shift in the species and tree size class dominance, as well as the canopy cover density. Prior to juniper encroachment, live oaks, post oaks, and elms were dominant canopy cover species, as indicated by their observed dominance following clearing activities. These trees were predominantly large in size (> 3 m canopy height), and cover density was lighter and more open in nature. The structure of this savannah and open grassland habitat allowed greater forage production, and possibly higher water yields as studies have indicated juniper trees utilize and transpire more water than the native grasses (Thurow and Hester 1997). As junipers encroached into the system, canopy cover increased, forage production decreased, and the dominant tree size shifted to a more even split between medium (1.2 - 3 m canopy height) and large trees. Juniper trees became the dominant species, growing beneath the taller and larger oaks and other hardwood species to occupy the lower stratus of the canopy. The removal of the junipers helped open up the canopy, allowing more light to reach the lower levels and encouraging greater forage production. Canopy cover changes, density, and dominant species results recorded in this study are based on subjective landowner observations. Pre-clearing data collected in the vegetative component of the LRRP study was consulted, however, and support the results of this study. Post-clearing vegetative data was not available for comparison at the time this study was completed. As stated in the results section, the average increase in forage production observed by landowners in the

treatment areas was 21%. Results recorded in the vegetative component of the LRRP would provide a more scientific representation of the actual increase in forage production, and should be consulted upon completion of the project.

Stocking Rate

Increased forage production allows landowners the potential to increase their stocking rates, as an animal unit may require fewer hectares to sustain it. The results from this study showed an average increase in animal units from 23 to 31 following juniper removal, with the required 8 ha/au (20 ac/au) falling to 6 ha/au (15 ac/au). These results are thought to be representative of the changes due to brush clearing alone. Due to an ongoing drought, several landowners had reduced their stocking rates, or were resting their property completely. Taking this in to consideration, landowners were asked to estimate the maximum number of animal units they would feel comfortable running on their property in the future. They were asked to make this decision with regard to what their idea of a "normal" year, in terms of precipitation, forage production, etc, was. The number of animal units a landowner chooses to run on his/her property is a managerial decision, with a number of factors influencing that choice. While forage production, precipitation, and brush cover influence this decision, the landowner's own experiences and knowledge of the land are major contributors to their idea of what proper stocking rate is. New landowners who have just moved into the area, with, for example, 5 years of ranching experience, have less basis of what a "normal" year in the area is. Their idea of optimal stocking rate has the potential to be very different from a landowner who has lived in the region and has 30 years of experience.

The economic benefits recognized in this study were based solely on changes in stocking rates, and the associated impacts on landowners' enterprise budgets. As suggested by other studies mentioned in the literature review section, many other potential benefits may be attributed to brush management that are not necessarily easily tested; especially those that occur off-site (ie, down stream of the landowners property) and/or that results in benefits that are in non-market services like wildlife habitat. In addition, changes such as increased animal health due to better forage quality, reduced labor costs, higher calf crops due to better animal health, and increased weight gains, may potentially be noticed following juniper removal (McBryde et al. 1984, Whitson et al. 1984, Vantassel and Conner 1986, Rowan and Conner 1994). These factors are difficult to test in an uncontrolled environment, but may contribute benefits to the landowner, or society in general, that help offset clearing costs. The benefits recognized from stocking rate changes were found to be the most measurable benefit with the way this project was designed.

It was found in this study, while the potential to increase stocking rates following brush removal may be there, some landowners chose not to. Several property managers involved with the LRRP indicated they were not interested in increasing their stocking rates, despite a noticeable increase in forage production. Most attributed this decision to just being satisfied they were doing something beneficial to the land, and that they did not want to cause added stress by running additional animals on the property. All property managers who had already, or were planning on, increasing their stocking rates displayed this same conscientiousness toward conservation. Their decision to increase their herd size came from careful consideration of the property and the numbers the land could

support. However, as mentioned above, this decision is strongly influenced by the landowner's past experience and knowledge of the land.

Basing their decisions on their personal management goals and knowledge, most land managers in this study indicated that the maximum animal units they would run was still below the number they felt the land could actually support based on their observation of forage production and other factors. The average increase in animal units and decrease in hectares required per animal unit following brush removal was found to be significantly different from pre-clearing activities.

Conducting additional interviews with these same landowners, 5, 8, 10, even 15 years down the line, would help provide a more comprehensive record of the results recognized by the brush clearing efforts of this project, as well as helping balance out the effects time and weather may play on results. Interviews conducted for this study were done only two to three years after clearing had been completed. Response curves for the regrowth of juniper following brush removal using hydraulic shears and bulldozing may be developed from these additional interviews as well. Response curves would allow the opportunity to demonstrate how different maintenance practices implemented by individual landowners, stocking rate decisions, etc., influence the land and the vegetative regrowth occurring after juniper clearing. Follow-up maintenance practices and their costs could be monitored as well, so future participants would have a better idea of what to plan for before they become involved with a clearing project. For a more scientific representation of the economic benefits that could be obtained from juniper removal, a comparison between the data collected from each different project component (vegetation, wildlife, water, and economic) should be conducted and applied to the

enterprise assumptions implemented in this study. Clipping samples, if taken, could monitor the actual stocking rates for cleared properties, both before and after juniper removal was completed. These stocking rates could then be applied to the budgets prepared for each individual enterprise, to serve as a guideline between what is recommended, and what stocking rates are actually being applied.

As mentioned in the results section, over 90% of the landowners who participated in this study stated that 30% or less of their income was obtained from activities on their land. Of that 90%, approximately 43% of the landowners received 5% or less of their income from activities on their land. A local tax appraiser from the study area indicated that there has been a shift in demand for the type of land buyers are interested in purchasing. Rather than purchasing land for agricultural purposes, new landowners are buying property to be used for recreation or hunting. The lower incomes recorded and attributed to land use activities in this study lend support to this trend. They also may offer another reason as to why some of the participating landowners chose to stock their property with a lower number of animal units than they might be able to if they based their decision on the increased forage production following juniper clearing. Because they are not as reliant on the production from their property, they are not as compelled to stock their ranches as heavily as if their property were their primary source of income. This shift in management objectives offers a potential opportunity for working with these newer landowners to develop conservation plans that are beneficial to them, their land, and the associated wildlife and plant species dependent on this habitat.

Enterprise Net Returns

Although differences in the average net returns for the combined enterprises were observed following brush clearing for those property managers who ran livestock enterprises, landowners who leased their property for grazing or hunting, showed no change. Differences in net returns to the enterprises, attributed to clearing, were found to be significantly different. Significant differences were also observed between owners who managed a hunting enterprise in addition to a second, livestock enterprise. Despite significant differences in net returns attributed to clearing, comparing the overall net returns following clearing, $53.00/ha, to the actual cost of clearing alone, $516.00/ha, a marked difference may be noted. Landowners receiving cost-share funds may be able to turn a profit from their land more quickly, regardless of clearing cost, if they are reimbursed for part of the expenses paid. Property managers who have to pay for all of the clearing costs out of their own pockets would not be able to recognize enough economic benefits without a second source of income, or utilizing money from other property not enrolled in brush clearing. The results also indicate that landowners can recognize a higher profit from their land if they utilize two or more non-competitive enterprises on their property. The benefits of running a hunting operation in addition to a livestock or leasing the land for grazing, can incur a higher financial benefit than that recognized by clearing.

Other studies mentioned in the literature review suggest clearing junipers less than four feet tall may be the most affordable. Although these studies suggest the benefits of clearing realized in these areas may not be as high as those found in areas of high brush cover and larger trees, they may be the most economical. The findings from

this study support this concept. The majority of land cleared under the LRRP had heavy juniper cover and medium to large size trees, requiring mechanical treatment. As the results show, while changes were observed following juniper removal, the benefits recognized still did not cover the cost of clearing. If landowners can treat a piece of property by more affordable methods, before mechanical treatments become the only option, they may prevent a more serious future problem.

Landowner Satisfaction

Comparisons were conducted between two cost-share programs, LRRP and EQIP, for this study. Of the four satisfaction factors measured, only two showed significant differences between the two programs. These differences were observed in the amount of cost-share support received, and the amount of paperwork required. In terms of the importance landowners place on these factors when determining whether to participate in a cost-share program, no significant differences were noticed between the two programs. These results seem to indicate that prior to enrolling in a program, landowners have similar expectations and feelings for what they consider important when deciding which program to participate in. For both LRRP and EQIP contracted landowners, the amount of cost-share benefits received, as might be expected, was found to be the most important factor in this decision-making process in this project. As was mentioned before, LRRP contracted landowners receive 85% cost-share benefits, while those with EQIP contracts receive only 50%. The satisfaction results showed a significant difference between satisfaction levels between those landowners participating under LRRP funds and those under EQIP funds, despite the averages for both falling into the “Keep up the Good Work” category on the grid. Comments offered by landowners following the structured

portion of the interviews provided possible insights into why some participants may have been disappointed with certain aspects of each program. The most commonly addressed frustration associated with EQIP contracts was the lack of flexibility associated with the clearing cost payments. When a participant signs up, they are locked into whatever clearing price is considered average for that year. If prices rise, landowners will still receive the same amount of cost-share support for the remainder of their contract. This caused financial strain for a few participants, who, stated that without second incomes, they would not have been able to afford finishing out their contract. A fine, which is a certain percentage of the total contract amount a landowner signs up for, is incurred should a landowner decide to end their contract early. Dissatisfied landowners found themselves struggling to determine what the best option was, finishing out their contract despite the higher clearing prices, or paying a fine to end the contract. Landowners signed up under LRRP contracts contribute a maximum payment of 15% of $15,000, or approximately $2250, upon signing up for the program. Landowners participating under LRRP contracts have a maximum dollar payment they make at the beginning of the program. The amount of land they are able clear with that maximum cost-share payment may vary according to the changing clearing prices. EQIP contracted participants, on the other hand, sign up for a certain amount of land they want cleared. They receive 50% cost share benefits for the set clearing price realized at the beginning of the contract, and are then responsible for paying the difference between the cost-share payments and actual clearing prices throughout their contract. Rising clearing prices can, therefore, drive up the amount of money EQIP participants must spend to have their designated land cleared.

The second significant difference noticed between the two cost-share programs, was in the satisfaction for the amount of required paperwork. No additional comments were offered by participants to reveal why these differences existed. However, in terms of overall program satisfaction, they may not be significant since the amount of paperwork fell into the "Possible Overkill" category, or were right on the line for the "Keep up the Good Work" quadrant.

The importance-performance matrix is a very effective tool for determining what areas of a program may need improvement, or those that are performing up to satisfactory standards. The importance scores help determine what factors are considered most important to landowners when they are deciding whether or not to participate in a program, while the performance scores indicate the participants' satisfaction with those same factors following their involvement with the project. Knowing this information can help program managers determine where their resources will be most effective, both in terms of recruiting future participants, and keeping current participants satisfied.

Participation in a cost-share program requires the landowner to perform background research to determine which program is most appropriate for them. If finances are limited, choosing a program with a set amount of money contributed, such as the LRRP, may be their best option. Paying a pre-determined price will help prevent these participants from finding themselves in a situation where they are no longer able to afford the program if unforeseen events occur. A landowner with a set amount of land they wish to perform brushwork on may find a program such as EQIP best for them. Because landowners are locked into their initial cost-share clearing price after signing the contract, enrolling a smaller amount of land and entering several shorter contracts over

the course of several years may help prevent long-term price impacts. These shorter, smaller contracts could be entered over the course of several years, until the desired amount of land is cleared. Enrolling the amount of land the individual believed he/she could clear within a year or two of work would help reduce the impact rising costs would play if landowners spread their work over the course of several years and are locked into the cost-share price they sign up for at the beginning of their contract. A potential drawback for this plan, however, is landowners are not guaranteed cost-share funding every time they apply for it. The amount of money allotted to each county for EQIP changes from year to year, as does the number of landowners applying for the cost-share program. A landowner signing up one year may not necessarily receive funding the following year if more landowners apply, or fewer dollars are delegated to the program. Signing up for a long term contract, addressing all of the desired brushwork, will ensure a landowner is able to accomplish his/her clearing goals, but they may pay more than expected if clearing prices rise. Attempting to clear as much as possible early on in the contract may help alleviate some of these risks.

Possible Study Limitations

Possible limitations were recognized for this study. The low number of interview participants makes it difficult to conclusively say whether the results obtained from the study would be representative for additional landowners interested in conducting juniper clearing. The ongoing status of the LRRP creates the opportunity to interview additional landowners scheduled to participate in the project. If baseline data could be obtained from these landowners prior to their brush work, post-clearing interviews could be conducted to expand the results recognized by the project.

An ongoing drought also may have had an impact on the results recognized by the project participants. Although an attempt to alleviate the potential impacts caused by the drought was made, it may still have influenced the answers provided by the participants.

An additional limitation of this study is the limited geographic area in which the interviews and juniper clearing were conducted. The LRRP is only being conducted within Coryell and Hamilton Counties. Results, therefore, may not be representative for participants in cost-share programs outside of this general study area.

Future comparisons with the vegetation monitoring component of the project may allow more definitive stocking rate changes, and the impact on enterprise budgets, to be calculated. As identified in the discussion section, many landowners indicated they were running fewer AUs on their property following juniper clearing than the increased forage would support. Several potential reasons behind this lower stocking rate were provided. Calculating the stocking rates from the actual forage production data would allow potential participants the opportunity to view a more scientific representation of the changes that can take place with juniper removal. The stocking rate changes identified by the landowners are based on many different factors, but individual management goals and opinions are a major determinant for how many AUs they will ultimately run on their property.

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APPENDIX A

A-1. Letter sent to LRRP interview participants prior to the call for arranging an interview date and time.

A&M Letterhead

Landowner Name
Landowner Contact Information

Dear Landowner,

My name is _____ and I am a Master's student in the Rangeland Ecology and Management Department at Texas A&M University. I am working under Dr. Richard Conner on the economic analysis for Phase II of the Leon River Restoration Project (LRRP). The LRRP began in 2002 as part of an effort to help reduce Ashe juniper densities on private lands throughout the Leon River watershed. In 2003, approximately 30 landowners were contacted by a former A&M Master's student, _____, for an interview prior to brush clearing on their land. The purpose of the interview was to establish baseline data on the land condition before Ashe Juniper was cleared.

The reason I am contacting you is that our records indicate you were a participant in the first round of interviews conducted by Jason. As part of a follow-up to his study, I will be performing post-clearing interviews with you and the other original participants. These interviews will focus on changes that have occurred on your property since juniper has been cleared from it. For instance, questions will cover topics such as acreage of land cleared, current woody species canopy cover, and changes, if any, in forage yields and stocking rates on cleared lands. The information obtained will be compared with the results from Jason's interviews to determine cost-benefit ratios and the cost-effectiveness of this type of brush clearing project.

I will be conducting interviews throughout the summer, beginning in July, and hope to finish by the end of August. The interviews will last approximately one hour. I will call you in advance to set up a time and meeting place that will be most convenient for you. Please feel free to contact me if you have any questions or concerns regarding the project or interview process. Thank you for your time and I look forward to meeting you this summer.

Sincerely,

Signature

Contact Info

A-2. Questionnaire for the economic analysis of the LRRP.

Interview Questionnaire
Leon River Restoration Project

Contact Name: _____

Phone Number: _____

Subwatershed: _____

Date Interviewed: _____

Interviewed By: _____

A. Property Information

Property Boundary and Pasture Identification

1. Verify the property boundary lines and individual pastures on the aerial map provided.
   Changes/Comments:

2. What is the total acreage owned within the area identified above?
   2003:
   Changes/Comments:

3. What is the estimated acreage of each of the individual pastures within the property boundary and is it improved (I) or native (N) pasture or cropland (C)?

Pasture	Acreage 2003	Classification 2003	Acreage 2006	Classification 2006

2003:
Changes/Comments:

Current Landscape Condition

4. Identify and label the location of any springs or streams on the aerial map.
   2003:
   Changes/Comments:

A-2, cont.

5. What is the condition of these springs and streams? (i.e. constant/intermittent flow, eroding, improving)

Spring/Stream ID	Flow Condition (Constant/Intermittent)		Channel Condition (Eroding/Improving)	
	2003	2006	2003	2006

Changes/Comments:

6. Locate, delineate, and label the boundary of any creek and stream bottomlands on the aerial map provided.
   Changes/Comments:

7. What are the characteristics of each of the creek and stream bottomland areas? Complete the table using the following classification categories for the woody vegetation:

   Percentage Cover: Open (0%-5%)
   Light (5%-20%)
   Moderate (20%-35%)
   Heavy (35%-100%)
   Approximate Size: Small (< 6" Trunk Dia. and < 8' Canopy Height)
   Medium (6"-16" Trunk Dia. and 8'-16' Canopy Height)
   Large (> 16" Trunk Dia. and > 16' Canopy Height)

Pasture/Field ID	Bottomland ID	Dominant Species		Percentage Woody Cover Class		Dominant Woody Size Class	
		2002	2006	2002	2006	2002	2006

Changes/Comments:

8. Locate and draw the approximate boundary of the brush covered areas within the individual pastures.
   2003:
   Changes/Comments:

A-2, cont.

9. What are the characteristics of each of the brush covered areas? Complete the table using the following classification categories for the woody vegetation:

   Percentage Cover: Light (0%-20%)
   Moderate (20%-35%)
   Heavy (35%-100%)
   Approximate Size: Small (< 3" Trunk Dia. and < 4' Canopy Height)
   Medium (3"-6" Trunk Dia. and 4'-10' Canopy Height)
   Large (> 6" Trunk Dia. and > 10' Canopy Height)

Pasture/ Field ID	Brush Cover ID		Dominant Species		Percentage Woody Cover Class		Dominant Woody Size Class	
	2003	2006	2003	2006	2003	2006	2003	2006

2003:
Changes/Comments:

10. What are the characteristics of the improved pastures on the property? Complete the table using the following classification categories for the dominant herbaceous vegetation cover:

    Stand Condition: Sparse (10%-25% Coverage)
    Medium (25%-75% Coverage)
    Dense (75%-100% Coverage)

Pasture/Field ID	Dominant Herbaceous Species		Stand Condition Class	
	2003	2006	2003	2006

Changes/Comments:

A-2, cont.

11. Approximately how much of your property was cleared of cedar?

Pasture/Field ID	Acreage Cleared

Preferred Landscape Condition

12. For each pasture/field and/or delineated segments within each, what would the preferred land cover be if different from the current land cover? Please discuss and/or draw the preferred land cover on the map provided based on the following categories:

    - Condition of the creek and stream bottomlands
    - Amount and location of brush cover
    - Amount and location of improved pastures, as well as the dominant species
    - Amount and location of native pastures

Pasture/Field ID	Bottomland/Brush Cover	Preferred Cover if Different from Current
	2006	2006

2003:
Changes/Comments:

13. Many springs and streams in the area have historically flowed year round or produced higher flows than they do today. On a scale of 1 to 5, with 5 being very important and 1 being unimportant, how important to you is it that any streams and springs on your property be restored to their historical conditions? (i.e. flow year round)

Spring/Stream ID	Rating (1 to 5)	
	2003	2006

Changes/Comments:

A-2, cont.

B. Enterprise Questions

Enterprise Identification

1. Identify the enterprise(s) for which each pasture/field identified on the aerial map is utilized. (i.e. crop type, livestock species and breed, hunting, leased out to others for crops/grazing, etc.)

Pasture/Field ID	Enterprises/Uses	
	2003	2006

Changes/Comments:

Enterprise Inputs and Returns on Non-Leased Property (Average Year)

2. Identify the average inputs and returns for the farmland by each crop type raised. Utilize available records as well as the provided Texas Cooperative Extension Budgets to complete an Enterprise Worksheet for each crop raised in a typical year.

3. Identify the average inputs and returns for all breeding livestock enterprises by species and breed. Utilize available records as well as the provided Texas Cooperative Extension Budgets to complete an Enterprise Worksheet for each breeding livestock enterprise in a typical year.

4. Identify the average inputs and returns for all stocker livestock enterprises by species and breed. Utilize available records as well as the provided Texas Cooperative Extension Budgets to complete an Enterprise Worksheet for each stocker livestock enterprise in a typical year.

5. Identify the average inputs and returns for non-traditional livestock enterprises (youth stock show, isolated markets, etc.)
   2003:
   Changes/Comments:

A-2, cont.

Enterprise Inputs and Returns on Leased Property (Average Year)

6. What is the typical enterprise within any leased pastures/fields that were identified as leased for crops or grazing, and what is the lease value per acre of those pastures/fields?

Pasture/Field ID	Enterprise		Lease Value per Acre ($/Acre)	
	2003	2006	2003	2006

Changes/Comments:

7. Do you limit the stocking rate on any of the pastures leased for grazing? If so, what is the stocking rate limited to?

Pasture/Field ID	Stocking Rate Limitations
	2006

2003:
Changes/Comments:

Hunting Enterprise Inputs and Returns on the Pastures/Fields used for Lease Hunting (Average Year)

8. What are the targeted wildlife species for hunting (deer, dove, quail, turkey)?

Pasture/Field ID	2003	2006

2003:
Changes/Comments:

9. How do you typically manage the hunting lease for each wildlife species? (i.e. leased by the gun, animal taken, by the acre, or specified time period/hunting season)
   2006:
   Changes/Comments:

A-2, cont.

10. What is your typical/average gross annual revenue from lease hunting? If you manage your hunting lease by wildlife species, please specify the gross annual revenue by species.

Wildlife Species Hunted	Estimated Gross Annual Revenue from Lease Hunting	
	2003	2006
TOTAL		

Changes/Comments:

11. How many hunters do you typically have in a year? If you manage your hunting lease by wildlife species, please specify the number of hunters per each wildlife species.

Wildlife Species Hunted	Number of Hunters in a typical year	
	2003	2006
TOTAL		

Changes/Comments:

12. What are your annual input costs, if any? (i.e. feeder maintenance and feed, state permits, wildlife management association or consulting)

Annual Expense Detail	Cost Per Unit ($/feeder, lb, acre, etc.)	Number of Units (feeders, lbs, acres, etc.)	Total Annual Cost ($/year)
		Total Expenses:	

Changes/Comments:

A-2, cont.

13. How many animals are taken in an average year (does, bucks, turkey, other), and do you feel that an improvement in the quality of the wildlife taken is needed?

Wildlife Species Hunted	Estimated Number of Animals Taken per Year		Improvement in Quality Needed? (Y/N)	
	2003	2006	2003	2006

Changes/Comments:

Other Enterprise Inputs and Returns (Recreation, Fishing, Public Access)

14. What are the estimated costs and returns of maintaining these other enterprises?
Changes/Comments:

A-2, cont.

C. Personal Information

1. Do you currently reside on your property?
   1……No 2…...Yes

2. How many years has your place been in your family?

3. For how long have you owned this property?

   Check one of the following:

   ___ Less than 3 years
   ___ 3 to 10 years
   ___ 11 to 25 years
   ___ More than 25 years (single generation)
   ___ More than one generation
   ___ Manage but don't own the property

4. Since age 18, how many years of ranching or farming experience do you have?

5. What is the age of the primary operator of this property?

6. If you own the property, have you sold any part of it during the last 3 years?
   (Yes___ No___ Don't own the land___)

   If yes: a) How many acres did you sell? (_____ Acres)

   b) Was the property you sold to be subdivided into smaller parcels?
   (Yes___ No___ Don't know___)

7. How many years do you estimate you will continue to own the property within the study area (delineated in Section A)?

   Check one of the following:

   ___ 1 to 3 years
   ___ 3 to 10 years
   ___ Indefinitely
   ___ I don't own the property

A-2, cont.

8. If you intend to sell any of the property in the study area (delineated in Section A) within the next 10 years, what portion of the property will you sell?

9. Approximately what percentage of your total family income was from activities on your land?
   2003:
   2006:

10. The following were identified as factors that may have contributed to whether or not landowners would participate in the Leon River Restoration Project. Rank these factors (from 1, Not Important at all, to 6, Extremely Important), in their significance to you when you deciding whether or not to participate in the project.

Importance Factors	Not Important at all		Slightly Unimportant	Slightly Important		Extremely Important
a. The amount of cost-share support provided……..	1	2	3	4	5	6
b. The length of the project contract…….	1	2	3	4	5	6
c. The amount of technical assistance provided……..	1	2	3	4	5	6
d. The amount of out beaurocratic paperwork required.....	1	2	3	4	5	6

A-2, cont.

11. Now that you have participated in the Leon River Restoration Project, rank (from 1, Very Poor to 6, Excellent) these same four factors in terms of your satisfaction with them.

Performance Factors	Very Poor	Poor	Fair	Good	Very Good	Excellent
a. The amount of cost-share support provided…..……...…..……	1	2	3	4	5	6
b. The contract length for the project ..……	1	2	3	4	5	6
c. The technical assistance provided…….....	1	2	3	4	5	6
d. The amount of beaurocratic paperwork involved…….....	1	2	3	4	5	6

A-3. Extension enterprise budgets for the West Central Texas area.

Projections for Planning Purposes Only *B-1241 (L7)*
Not to be used without Updating after February 15, 2003

Cow-Calf Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

PRODUCTION Description	Quantity	Unit	$ / Unit	Return
CULL COWS	0.14Hd 10.000	cwt.	35.0000	49.00
HEIFER CALVES	0.28Hd 4.500	cwt.	88.0000	110.88
STOCKER STEERS	0.43Hd 5.000	cwt.	92.0000	197.80
Total GROSS Income				357.68

OPERATING INPUT or CUSTOM OPERATION Description	Input Use	Unit	$ / Unit	Cost
BULL EXPENSE	0.033	head	250.000	8.30
DEATH LOSS	0.030	$	357.230	10.72
HAY	1.000	roll	40.000	40.00
MISC. EXPENSE COW-CALF	1.000	head	12.000	12.00
SALES COMMISSION	0.850	head	9.750	8.29
SALT AND MINERAL	30.000	lb.	0.180	5.40
SUPPL. FEED	300.000	lb.	0.120	36.00
VET. MEDICINE COW-CALF	1.000	head	15.000	15.00
Fuel				7.61
Lube				0.76
Repair				2.15
Total OPERATING INPUT and CUSTOM OPERATION Costs				146.22

Residual returns to capital, ownership labor, land, management, and profit	211.46

CAPITAL INVESTMENT Description	Quantity Invested	Unit	Rate of Return	Cost
Interest - IT Borrowed	1044.111	Dol.	0.090	93.97
Interest - OC Borrowed	102.854	Dol.	0.090	9.26
Interest - OC Earned	-4.591	Dol.	0.045	-0.21
Total CAPITAL INVESTMENT Costs				103.02

Residual returns to ownership, labor, land, management, and profit	108.44

OWNERSHIP COST Description (Depreciation, Taxes, and Insurance)	Cost
Machinery and Equipment	31.31
Livestock	4.98
Total OWNERSHIP Costs	36.29

Residual returns to labor, land, management, and profit	72.15

LABOR COST Description	Input Use	Unit	Average Rate	Cost
Machinery and Equipment	3.459	Hr.	5.649	19.54
Other	7.200	Hr.	5.600	40.32
Total LABOR Costs				59.86

Residual returns to land, management, and profit	12.29

LAND COST Description	Input Use	Unit	Rate of Return	Cost
PASTURE RENT				
Annual Lease	25.000	Acre	3.500	87.50
Total LAND Costs				87.50

Residual returns to management and profit	-75.21
Residual returns to profit	-75.21
Total Projected Cost of Production	432.89

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Projections for Planning Purposes Only *B-1241 (L7)*
Not to be used without Updating after February 15, 2003

Cow-Calf Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

GROSS INCOME Description	Quantity	Unit	$ / Unit	Total
CULL COWS	0.14Hd 10.000	cwt.	35.0000	49.00
HEIFER CALVES	0.28Hd 4.500	cwt.	88.0000	110.88
STOCKER STEERS	0.43Hd 5.000	cwt.	92.0000	197.80
Total GROSS Income				357.68

VARIABLE COST Description	Total
BARN	0.04
BULL EXPENSE	8.30
DEATH LOSS	10.72
FENCE 1 MILE	2.91
HAY	40.00
Interest - Earned	-0.21
Interest - OC Borrowed	9.26
LIVESTOCK LABOR	40.32
MISC. EXPENSE COW-CALF	12.00
PICKUP TRUCK 3/4 TON	26.78
SALES COMMISSION	8.29
SALT AND MINERAL	5.40
SHED	0.02
STOCK SPRAYER	0.04
STOCK TRAILER	0.04
SUPPL. FEED	36.00
VET. MEDICINE COW-CALF	15.00
WATER	0.18
WORKING PENS	0.04
Total VARIABLE COST	215.13

GROSS INCOME minus VARIABLE COST	142.55

FIXED COST Description	Unit	Total
Machinery and Equipment	Acre	67.08
Livestock		63.18
Land	Acre	87.50
Total FIXED Cost		217.76
Total of ALL Cost		432.89
NET PROJECTED RETURNS		-75.21

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Projections for Planning Purposes Only *B-1241 (L7)*
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Meat Goat Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

PRODUCTION Description		Quantity	Unit	$ / Unit	Return
CULL DOES	1.11Hd	100.000	lb.	0.5000	55.50
KID GOATS	MEAT 5.28Hd	50.000	head	1.0000	264.00
Total GROSS Income					319.50

OPERATING INPUT or CUSTOM OPERATION Description		Input Use	Unit	$ / Unit	Cost
BUCK EXPENSE	MGOAT	0.190	head	125.000	23.75
DEATH LOSS	MGOAT	0.040	$	319.440	12.78
MARKETING	GOATS	6.390	head	2.000	12.78
MISC. EXPENSE	GOATS	5.560	head	1.000	5.56
SALT AND MINERAL	GOATS	38.900	lb.	0.300	11.67
SUPPLEMENTAL FEE	GOATS	166.700	lb.	0.080	13.34
VET. MEDICINE	MGOATS	11.940	head	0.980	11.70
Fuel					7.61
Lube					0.76
Repair					2.15
Total OPERATING INPUT and CUSTOM OPERATION Costs					102.09

Residual returns to capital, ownership labor, land, management, and profit	217.41

CAPITAL INVESTMENT Description	Quantity Invested	Unit	Rate of Return	Cost
Interest - IT Borrowed	401.313	Dol.	0.090	36.12
Interest - OC Borrowed	132.221	Dol.	0.090	11.90
Interest - OC Earned	-1.884	Dol.	0.045	-0.08
Total CAPITAL INVESTMENT Costs				47.93

Residual returns to ownership, labor, land, management, and profit	169.48

OWNERSHIP COST Description (Depreciation, Taxes, and Insurance)	Cost
Machinery and Equipment	31.31
Livestock	0.25
Total OWNERSHIP Costs	31.56

Residual returns to labor, land, management, and profit	137.91

LABOR COST Description	Input Use	Unit	Average Rate	Cost
Machinery and Equipment	3.459	Hr.	5.649	19.54
Other	8.350	Hr.	5.600	46.76
Total LABOR Costs				66.30

Residual returns to land, management, and profit	71.62

LAND COST Description	Input Use	Unit	Rate of Return	Cost
PASTURE RENT Annual Lease	25.000	Acre	3.500	87.50
Total LAND Costs				87.50

Residual returns to management and profit	-15.88
Residual returns to profit	-15.88
Total Projected Cost of Production	335.38

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Projections for Planning Purposes Only *B-1241 (L7)*
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Meat Goat Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

GROSS INCOME Description		Quantity	Unit	$ / Unit	Total
CULL DOES	1.11Hd	100.000	lb.	0.5000	55.50
KID GOATS	MEAT 5.28Hd	50.000	head	1.0000	264.00
Total GROSS Income					319.50

VARIABLE COST Description		Total
BARN		0.04
BUCK EXPENSE	MGOAT	23.75
DEATH LOSS	MGOAT	12.78
FENCE	1 MILE	2.91
Interest - Earned		-0.08
Interest - OC Borrowed		11.90
LIVESTOCK LABOR		46.76
MARKETING	GOATS	12.78
MISC. EXPENSE	GOATS	5.56
PICKUP TRUCK	3/4 TON	26.78
SALT AND MINERAL	GOATS	11.67
SHED		0.02
STOCK SPRAYER		0.04
STOCK TRAILER		0.04
SUPPLEMENTAL FEE	GOATS	13.34
VET. MEDICINE	MGOATS	11.70
WATER		0.18
WORKING PENS		0.04
Total VARIABLE COST		180.20

GROSS INCOME minus VARIABLE COST	139.30

FIXED COST Description	Unit	Total
Machinery and Equipment	Acre	67.08
Livestock		0.60
Land	Acre	87.50
Total FIXED Cost		155.18
Total of ALL Cost		335.38
NET PROJECTED RETURNS		-15.88

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Projections for Planning Purposes Only *B-1241 (L7)*
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Sheep Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

PRODUCTION Description		Quantity	Unit	$ / Unit	Return
CULL EWES	SHEEP	1.10Hd 130.000	lb.	0.3500	50.05
LAMBS		4.40Hd 75.000	lb.	0.8500	280.50
WOOL		44.000	lb.	0.4000	17.60
Total GROSS Income					348.15

OPERATING INPUT or CUSTOM OPERATION Description		Input Use	Unit	$ / Unit	Cost
DEATH LOSS	SHEEP	0.040	$	347.800	13.91
MARKETING	SHEEP	5.490	head	2.000	10.98
MISC. EXPENSE	SHEEP	5.490	head	1.000	5.49
RAM EXPENSE		0.180	head	100.000	18.00
SALT AND MINERALS	SHEEP	54.900	lb.	0.300	16.47
SHEARING	SHEEP	5.500	head	2.000	11.00
SUPPLEMENTAL FEES	SHEEP	494.500	lb.	0.080	39.56
VET. MEDICINE	SHEEP	10.990	head	1.250	13.74
Fuel					7.61
Lube					0.76
Repair					2.15
Total OPERATING INPUT and CUSTOM OPERATION Costs					139.67

Residual returns to capital, ownership labor, land, management, and profit	208.48

CAPITAL INVESTMENT Description	Quantity Invested	Unit	Rate of Return	Cost
Interest - IT Borrowed	401.313	Dol.	0.090	36.12
Interest - OC Borrowed	76.747	Dol.	0.090	6.91
Interest - OC Earned	-28.000	Dol.	0.045	-1.26
Total CAPITAL INVESTMENT Costs				41.77

Residual returns to ownership, labor, land, management, and profit	166.72

OWNERSHIP COST Description (Depreciation, Taxes, and Insurance)	Cost
Machinery and Equipment	31.31
Livestock	0.25
Total OWNERSHIP Costs	31.56

Residual returns to labor, land, management, and profit	135.16

LABOR COST Description	Input Use	Unit	Average Rate	Cost
Machinery and Equipment	3.459	Hr.	5.649	19.54
Other	8.350	Hr.	5.600	46.76
Total LABOR Costs				66.30

Residual returns to land, management, and profit	68.86

LAND COST Description	Input Use	Unit	Rate of Return	Cost
PASTURE RENT				
Annual Lease	25.000	Acre	3.500	87.50
Total LAND Costs				87.50

Residual returns to management and profit	-18.64

Residual returns to profit	-18.64

Total Projected Cost of Production	366.79

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Projections for Planning Purposes Only *B-1241 (L7)*
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Sheep Production
West Central Texas (7)
2003 Projected Cost and Returns per Animal Unit

GROSS INCOME Description		Quantity	Unit	$ / Unit	Total
CULL EWES	SHEEP 1.10Hd	130.000	lb.	0.3500	50.05
LAMBS	4.40Hd	75.000	lb.	0.8500	280.50
WOOL		44.000	lb.	0.4000	17.60
Total GROSS Income					348.15

VARIABLE COST Description		Total
BARN		0.04
DEATH LOSS	SHEEP	13.91
FENCE	1 MILE	2.91
Interest - Earned		-1.26
Interest - OC Borrowed		6.91
LIVESTOCK LABOR		46.76
MARKETING	SHEEP	10.98
MISC. EXPENSE	SHEEP	5.49
PICKUP TRUCK	3/4 TON	26.78
RAM EXPENSE		18.00
SALT AND MINERALS	SHEEP	16.47
SHEARING	SHEEP	11.00
SHED		0.02
STOCK SPRAYER		0.04
STOCK TRAILER		0.04
SUPPLEMENTAL FEES	SHEEP	39.56
VET. MEDICINE	SHEEP	13.74
WATER		0.18
WORKING PENS		0.04
Total VARIABLE COST		211.61

Break-Even Price, Total Variable Cost $ - 0.60 per lb. of CULL EWES

GROSS INCOME minus VARIABLE COST		136.54

FIXED COST Description	Unit	Total
Machinery and Equipment	Acre	67.08
Livestock		0.60
Land	Acre	87.50
Total FIXED Cost		155.18

Break-Even Price, Total Cost $ 0.48 per lb. of CULL EWES

Total of ALL Cost		366.79

FIXED COST Description	Unit	Total
NET PROJECTED RETURNS		-18.64

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Projections for Planning Purposes Only *B-1241 (C7)*
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Table 1. Parameters

Diesel Fuel (DI) Price . . . . . .($/gal):	0.95
Electricity (EL) Price . . . . . .($/kWh):	0.07
Gasoline (GA) Price. . . . . .($/gal):	1.25
LP Gas (LP) Price. . . . . .($/gal):	1.12
Natural Gas (NG) Price . . . . . .($/Mcf):	5.37
Operator Labor (OL) Wage Rate. . . ($/hr):	8.00
Hand Labor (HL) Wage Rate. . . . . ($/hr):	8.00
Irrigation Labor (IL) Wage Rate. . ($/hr):	8.00
Owner Labor (WL) Wage Rate . . . . ($/hr):	8.00
Short-term Interest Rate . . . . . .(%):	9.00
Intermediate-term Interest Rate. . . .(%):	9.00
Comment at End of Table Titles . . . . . :	
Comment at End of Tables:	

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Projections for Planning Purposes Only *B-1241 (C7)*
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Table 2. Self-Propelled Machines

RECORD NUM	ITEM NAME	SIZE	PERF RATE	FUEL TYPE	FUEL CONS RATE	LABOR TYPE	LABOR MULT	PURCHASE PRICE	SV RATE	R&M RATE	USEFUL LIFE	ANNUAL USE
2	4 row stripper		0.2500	DI	6.00	OL	0.00	45000.00	60.00	50.00	10.00	200.00
1	pickup truck	3/4 ton	0.0067	DI	15.00	OL	0.00	23110.00	16.00	80.00	10.00	1500.00

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Projections for Planning Purposes Only *B-1241 (C7)*
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Table 3. Tractors

RECORD NUM	ITEM NAME	SIZE	FUEL TYPE	FUEL CONS RATE	LABOR TYPE	LABOR MULT	PURCHASE PRICE	SV RATE	R&M RATE	USEFUL LIFE	ANNUAL USE
1	tractor 100 hp	100	DI	5.40	OL	1.00	54514.00	65.0	50.00	10.00	400.00
2	tractor 125	125	DI	6.69	OL	1.00	74253.00	65.0	50.00	10.00	500.00
3	tractor 150	150	DI	7.72	OL	1.00	80073.00	65.0	50.00	10.00	600.00
4	Tractor 40	40	DI	2.57	OL	1.00	21283.00	65.0	50.00	10.00	350.00
5	Tractor 75	75	DI	3.86	OL	1.00	34748.00	65.0	50.00	10.00	400.00

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Table 4. Implements

RECORD NUM	ITEM NAME	SIZE	PERF RATE	TRAC NUM	TRAC MULT	FUEL MULT	LABOR TYPE	ADD LABOR	PURCHASE PRICE	SV RATE	R&M RATE	USEFUL LIFE	ANNUAL USE
29	8 row hooded sprayer		0.1577	2	1.00	1.00		0.00	2000.00	10.00	70.00	10.00	125.00
1	chisel		0.1980	5	1.00	1.00		0.00	3300.00	10.00	70.00	10.00	150.00
2	chisel 26 ft	26 ft	0.0996	3	1.00	1.00		0.00	6200.00	10.00	70.00	10.00	300.00
3	combine peanut		0.5978	1	1.00	1.00		0.00	14850.00	10.00	70.00	10.00	200.00
26	cotton stripper	6.6 ft	0.6663	1	1.00	1.00		0.00	12050.00	10.00	70.00	10.00	450.00
4	cultivator 4 row		0.2474	5	1.00	1.00		0.00	2500.00	10.00	70.00	10.00	150.00
5	cultivator 6 row		0.1473	5	1.00	1.00		0.00	4000.00	10.00	70.00	10.00	150.00
27	cultivator 8 row		0.1100	3	1.00	1.00		0.00	6000.00	10.00	70.00	10.00	150.00
6	cultivator rolling		0.1608	5	1.00	1.00		0.00	3300.00	10.00	70.00	10.00	175.00
7	digger - peanut		0.3420	1	1.00	1.00		0.00	6050.00	10.00	70.00	10.00	175.00
8	disc - tandem	13 ft	0.1592	5	1.00	1.00		0.00	4500.00	10.00	70.00	10.00	150.00
9	disc-tandem 21 feet	21 ft	0.1051	1	1.00	1.00		0.00	18000.00	10.00	70.00	10.00	225.00
10	disc/bedder	18 ft	0.1432	1	1.00	1.00		0.00	3050.00	10.00	70.00	10.00	150.00
11	drill - 12 ft	12 ft	0.2387	5	1.00	1.00		0.00	3850.00	10.00	70.00	10.00	150.00
12	drill - 8 ft	8 ft	0.3580	4	1.00	1.00		0.00	2000.00	10.00	70.00	10.00	150.00
13	fert. spreader	20 ft	0.1161	4	1.00	1.00		0.00	2000.00	10.00	70.00	10.00	100.00
14	lister	20 ft	0.1145	1	1.00	1.00		0.00	1590.00	10.00	70.00	10.00	225.00
15	lister/bedder		0.2423	1	1.00	1.00		0.00	2850.00	10.00	70.00	10.00	150.00
16	lister/planter		0.1145	1	1.00	1.00		0.00	4500.00	10.00	70.00	10.00	175.00
17	moldboard plow	4 bottom	0.4745	2	1.00	1.00		0.00	4250.00	10.00	70.00	10.00	200.00
18	planter 4 row	13 ft	0.1894	5	1.00	1.00		0.00	1695.00	10.00	70.00	10.00	75.00
19	planter 6 row	18 ft	0.1527	5	1.00	1.00		0.00	9350.00	10.00	70.00	10.00	225.00
28	planter 8 row		0.1345	2	1.00	1.00		0.00	11000.00	10.00	70.00	10.00	225.00
20	sand fighter	22 ft.	0.0572	4	1.00	1.00		0.00	1000.00	10.00	70.00	10.00	125.00
21	shredder - 2 row	6 ft	0.4424	4	1.00	1.00		0.00	2000.00	10.00	70.00	10.00	100.00
22	shredder 4 row	13 ft	0.2095	5	1.00	1.00		0.00	5000.00	10.00	70.00	10.00	150.00
24	sprayer - 24 ft		0.1351	5	1.00	1.00		0.00	2750.00	10.00	70.00	10.00	125.00
23	sprayer 12 ft		0.2644	4	1.00	1.00		0.00	1200.00	10.00	70.00	10.00	100.00
25	sprayer mounted	60 ft	0.1577	2	1.00	1.00		0.00	650.00	10.00	70.00	10.00	125.00

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Projections for Planning Purposes Only *B-1241 (C7)*
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Table 5. Operating Inputs

RECORD NUM	ITEM NAME	UNIT	PRICE	COST YIELD?	COMMENT
crop insurance					
7	cotton insurance	acre	13.00		
8	dry cotton insurance	acre	12.00		
84	sorghum insurance	acre	3.00		
9	wheat insurance	acre	4.25		
custom					
75	boll weevil erad	acre	8.00		
63	cust. harv - wheat	acre	12.00		
62	cust. harv. - sorghu	acre	11.00		
60	custom baling	bale	0.80		
61	custom combining	acre	10.00		
68	custom fertlizing	acre	1.75		
64	custom haul - oats	bu.	0.30		
65	custom haul - sorghu	cwt.	0.20		
66	custom haul - wheat	bu.	0.20		
67	drying - peanuts	ton	22.50		
15	gin, bags, ties	lb.	0.12		
70	haul & mkt - stocker	head	7.50		
69	haul & stack	bale	0.40		
71	insect appl.	acre	3.50		
72	overage - wheat	bu.	0.12		
48	shearing - goats	head	1.65		
49	shearing - sheep	head	2.00		
73	sprigging	acre	30.00		
74	stripping	lb.	0.07		
feed					
16	hay	bale	2.00		
23	lamb feed	lb.	0.09		
59	pasture - wheat	lb.	0.32		
38	range cubes	lb	0.10		
40	salt & mineral	lb.	0.15		
51	suppl. feed - goats	lb.	0.08		
52	suppl. feed - sheep	lb.	0.08		
fertilizer					
11	fert (N) - wheat	lb	0.12		
10	fert (N) applied	lb	0.30		
12	fert (P) - applied	lb.	0.30		
83	fertilizer	lb.	0.12		
34	nitrogen	lb.	0.16		
35	phosphate	lb.	0.23		
36	potash	lb.	0.12		
fungicide					
13	fungicide - foliar	appl	4.25		
14	fungicide - soil	appl	7.00		
harvest					
76	defoliant - cyclone	acre	4.75		
herbicide					
18	herbicide	lb.	7.00		
19	herbicide - cotton	pint	2.40		
17	pre-emerge, herb	acre	3.40		
insecticide					
85	insec&appl-sorghum	acre	7.00		
20	insecticide	appl	11.50		
21	insecticide - cotton	lb.	6.25		
22	insecticide - wheat	acre	6.25		
misc.					
1	advertising - deer	year	100.00		
2	allotment leas. pean	lb.	0.02		
5	broker - cotton	acre	1.25		
4	buck exp. - mgoat	head	72.15		
3	buck expense - goat	head	81.02		
24	deer license	year	135.00		
25	marketing - goat	head	1.75		
26	marketing - sheep	head	1.75		
31	misc - cotton	acre	5.00		
27	misc - cow/calf	dollar	1.00		
32	misc - stocker	dollar	2.00		
33	misc - wheat	acre	1.00		
29	misc- goats	head	1.00		
28	misc. - deer	dollar	500.00		
30	misc. - sheep	dollar	1.00		
37	ram expense	head	79.12		
39	sales commission	head	8.00		
50	stocker steers	cwt.	70.00		
pre-harvest					
81	caparol + direx	acre	3.00		
86	caparol+direx 2	acre	3.50		
82	generic RU	acre	4.00		
87	generic RU 2	acre	6.50		
88	generic RU 3	acre	5.00		
89	Generic Ru and 24D	acre	6.12		
seed					
41	seed - cotton	lb.	1.27		

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42	seed - klein grass	lb	5.00
43	seed - oats	bu	6.00
crop insurance			
47	seed - rye	lb.	0.14
seed			
44	seed - sorghum	lb.	2.00
45	seed - wheat	bu.	0.15
46	seed -peanut	lb.	0.82
6	seed corn	lb	0.06
vet. medicine			
54	vet - cow/calf	head	14.32
55	vet - goats	head	1.65
56	vet - mgoats	head	0.98
53	vet fert. test - bul	year	40.00
57	vet. - sheep	head	1.25
58	vet. - stocker	head	12.50

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Table 6. Other Durable Inputs

RECORD NUM	ITEM NAME	UNIT	FUEL TYPE	FUEL CONS RATE	R&M COST	LABOR TYPE	LABOR USE	FIXED COST /UNIT	FIXED COST /ACRE	COMMENT
1	irrigation	ac/in	NG	1.0000	2.030		0.0640	0.000	33.60	

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Table 7. Operating Input Categories

RECORD NUM	ITEM NAME
6	crop insurance
4	custom
8	feed
2	fertilizer
5	fungicide
11	harvest
3	herbicide
10	insecticide
7	misc.
12	pre-harvest
1	seed
9	vet. medicine

A-3, cont.

Projections for Planning Purposes Only *B-1241 (C7)*
Not to be used without Updating after February 15, 2003

Table 8. Products

RECORD NUM	ITEM NAME	UNIT	PRICES BUDGET	CONTRACT	LOAN	FUTURES	HIGH	AVERAGE	LOW	COMMENT
1	cotton lint	lb.	0.52	0.00	0.00	0.00	0.00	0.00	0.00	
2	cottonseed	ton	110.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	hay - coastal	ton	45.00	0.00	0.00	0.00	0.00	0.00	0.00	
4	hay - sorghum	ton	35.00	0.00	0.00	0.00	0.00	0.00	0.00	
5	oats	bu.	1.25	0.00	0.00	0.00	0.00	0.00	0.00	
6	pasture - coastal	aum	8.00	0.00	0.00	0.00	0.00	0.00	0.00	
7	pasture - klein gras	aum	8.00	0.00	0.00	0.00	0.00	0.00	0.00	
8	pasture - sm. grain	aum	8.00	0.00	0.00	0.00	0.00	0.00	0.00	
9	pasture - wheat	lb/g	0.32	0.00	0.00	0.00	0.00	0.00	0.00	
10	peanuts	lb.	0.30	0.00	0.00	0.00	0.00	0.00	0.00	
11	sorghum	cwt	4.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	wheat	bu.	3.50	0.00	0.00	0.00	0.00	0.00	0.00	

Information presented is prepared solely as a general guide and is not intended to recognize or predict the cost and returns from any on particular farm or ranch operation.
These projections were collected and developed by staff members of Texas Cooperative Extension and approved for publication.

A-3, cont.

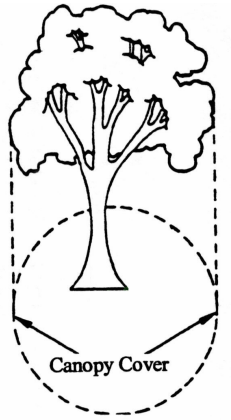
Table 9. Allocated Cost Items

RECORD NUM	ITEM NAME	CALC NUM	DOLLARS PER ACRE	% OF INCOME	% OF DIRECT EXPENSES	% OF TOTAL EXPENSES
3	crops	1	12.00	0.00	0.00	0.00
1	dry land cotton	1	27.77	0.00	0.00	0.00
4	forage	1	12.00	0.00	0.00	0.00
2	irr. cotton	1	80.00	0.00	0.00	0.00
9	land charge-sorghum	1	29.00	0.00	0.00	0.00
6	pasture rent	1	7.00	0.00	0.00	0.00
5	wheat	1	29.00	0.00	0.00	0.00

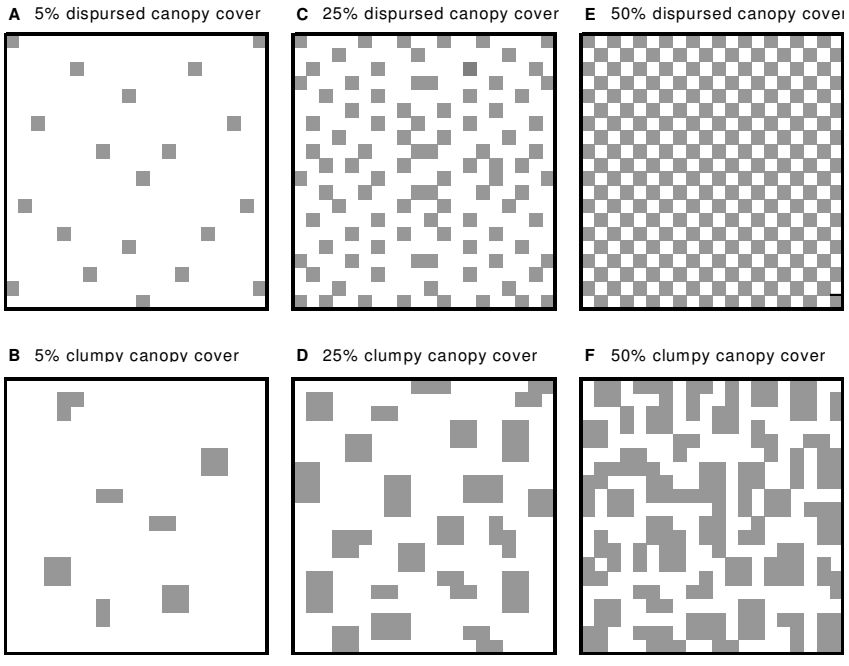
A-4. Canopy cover diagram used in interviews to help landowners determine the cover class their cleared property fell in.

Woody Vegetation Canopy
Percent Cover Illustration

CANOPY COVER is defined as the total ground area covered by the aboveground parts (branches, leaves) of woody plants, as shown on the diagram below.



SCATTER DIAGRAMS showing three distribution patterns for 5%, 25% and 50% canopy cover. The first column (diagrams A and B) shows a dispersed and a clumpy pattern for 5% canopy cover, second column (diagrams C and D) shows a dispersed and a clumpy pattern for 25% canopy cover, and third column (diagrams E and F) shows a dispersed and a clumpy pattern for 50% canopy cover. OPEN COVER = densities less than that shown in the first column, LIGHT COVER = densities between first and second column, MODERATE COVER = densities between second and third column, HEAVY COVER = densities greater than that shown in the third column.



A-5. EQIP cost-share rates for Coryell County (2003-2006).

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	CORYELL	**FIP Code:**	48099
Fiscal Year:	2003	**Cost List:**	TexasCoryellEQIP03-02	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$45
314	Brush Management	HANDCUTTING - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	HYDRAULIC SHEARS - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$45
314	Brush Management	HYDRAULIC SHEARS - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$35
314	Brush Management	STACKING AND PILING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$40
314	Brush Management	TREEDOZING - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$100
314	Brush Management	TREEDOZING - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$70
338	Prescribed Burning	PRESCRIBED BURN DOUBLE FIREGUARD	Apply controlled fire to predetermined area.	ac.	AC	$8

A-5, cont.

528A	Prescribed Grazing	PRESCRIBED GRAZING INCENTIVE	Grazing will be managed according to a schedule that meets the needs of the soil, water, air, plant and animal resources and the objectives of the resource manager.	ac.	FR	$17
550	Range Planting	PREPARATION, SEEDING OP, & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$80
910	TA PLANNING	Reimbursement of conservation planning activities by a technical service provider.		No	AM	$0
911	TA DESIGN	Reimbursement of conservation design activities by a technical service provider.		No	AM	$0
912	TA APPLICATION	Reimbursement of conservation application activities by a technical service provider.		No	AM	$0
913	TA CHECK-OUT	Reimbursement of conservation installation activities by a technical service provider.		No	AM	$0
CORYELL County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov					

A-5, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	CORYELL	**FIP Code:**	48099
Fiscal Year:	2004	**Cost List:**	TXCoryellEQIP04-02	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$30
314	Brush Management	MECH. BRUSH TREAT. - HEAVY - STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$185
314	Brush Management	MECHANICAL BRUSH TREATMENT - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$90
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac.	AC	$8
528A	Prescribed Grazing	PRESCRIBED GRAZING INCENTIVE	Grazing will be managed according to a schedule that meets the needs of the soil, water, air, plant and animal resources and the objectives of the resource manager.	ac.	FR	$17
550	Range Planting	W/ HEAVY EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$100
550	Range Planting	W/ LIGHT EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$50

A-5, cont.

910	TA PLANNING	Reimbursement of conservation planning activities by a technical service provider.	No	AM	$0
911	TA DESIGN	Reimbursement of conservation design activities by a technical service provider.	No	AM	$0
	TA APPLICATION	Reimbursement of conservation application activities by a technical service provider.	No	AM	$0
913	TA CHECK-OUT	Reimbursement of conservation installation activities by a technical service provider.	No	AM	$0
CORYELL County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov				

A-5, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	CORYELL	**FIP Code:**	48099
Fiscal Year:	2005	**Cost List:**	TXCoryellEQIP 200205-01	**Description:**	County Base Funds

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$30
314	Brush Management	MECH. BRUSH TREAT.-HEAVY- STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$185
314	Brush Management	MECHANICAL BRUSH TREATMENT - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$90
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac.	AC	$8
550	Range Planting	RANGE PLANTING ON CROPLAND	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$100
550	Range Planting	W/ HEAVY EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$100
550	Range Planting	W/ LIGHT EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$50

A-5, cont.

CORYELL County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov

A-5, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	CORYELL	**FIP Code:**	48099
Fiscal Year:	2006	**Cost List:**	TXCoryellEQIP 200206-03	**Description:**	Coryell County Base

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$30
314	Brush Management	MECH. BRUSH TREAT - HEAVY-STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$200
314	Brush Management	MECH. BRUSH TREAT.- MEDIUM- STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$140
314	Brush Management	MECHANICAL BRUSH TREATMENT - LIGHT	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$60
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac	AC	$8
378	Pond	EXCAVATED OR EMBANKMENT	Construct a water impoundment to provide water.	cu.yd	AC	$1.2
382	Fence	PERMANENT NONELECTRIC	Construct a fence for use as a barrier to wildlife, livestock, or people.	ft	AC	$1.6
512	Pasture and Hay Planting	SEEDBED PREP., SEEDING OP., PACK, & SEED	Establish forage species for grazing or mechanical harvest.	ac	AC	$60
516	Pipeline	PVC	Install a pipeline to convey water from supply source to points of use.	ft	AC	$1.8

A-5, cont.

550	Range Planting	SEEDBED PREP., SEEDING OP., PACK & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	Ac	AC	$60
910	TA PLANNING	TA Planning		NO.	AM	$0
911	TA DESIGN	TA Design		NO.	AM	$0
912	TA APPLICATION	TA Application		NO.	AM	$0
913	TA CHECK-OUT	TA Reimbursement for Construction Check-Out		NO.	AM	$0

CORYELL County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov

A-6. EQIP cost-share rates for Hamilton, County (2003-2006).

Updated 05/02/2006

State:	Texas (TX)	**County:**	HAMILTON	**FIP Code:**	48193
Fiscal Year:	2003	**Cost List:**	TexasHamiltonEQIP03-02	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$45
314	Brush Management	HANDCUTTING - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	HYDRAULIC SHEARS - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$45
314	Brush Management	HYDRAULIC SHEARS - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$35
314	Brush Management	STACKING AND PILING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$40
314	Brush Management	TREEDOZING - HEAVY	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$100
314	Brush Management	TREEDOZING - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$70
338	Prescribed Burning	PRESCRIBED BURN DOUBLE FIREGUARD	Apply controlled fire to predetermined area.	ac.	AC	$8
528A	Prescribed Grazing	PRESCRIBED GRAZING INCENTIVE	Grazing will be managed according to a schedule that meets the needs of the soil, water, air, plant and animal resources and the objectives of the resource manager.	ac.	FR	$17
550	Range Planting	PREPARATION, SEEDING OP, & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$80

A-6, cont.

910	TA PLANNING	Reimbursement of conservation planning activities by a technical service provider.	No	AM	$0
911	TA DESIGN	Reimbursement of conservation design activities by a technical service provider.	No	AM	$0
912	TA APPLICATION	Reimbursement of conservation application activities by a technical service provider.	No	AM	$0
913	TA CHECK-OUT	Reimbursement of conservation installation activities by a technical service provider.	No	AM	$0
HAMILTON County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov				

A-6, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	HAMILTON	**FIP Code:**	48193
Fiscal Year:	2004	**Cost List:**	TXHamiltonEQIP04-02	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$30
314	Brush Management	MECH. BRUSH TREAT. - HEAVY - STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$185
314	Brush Management	MECHANICAL BRUSH TREATMENT - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$90
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac.	AC	$8
528A	Prescribed Grazing	PRESCRIBED GRAZING INCENTIVE	Grazing will be managed according to a schedule that meets the needs of the soil, water, air, plant and animal resources and the objectives of the resource manager.	ac.	FR	$17
550	Range Planting	W/ HEAVY EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$100
550	Range Planting	W/ LIGHT EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$50

A-6, cont.

910	TA PLANNING	Reimbursement of conservation planning activities by a technical service provider.	No	AM	$0
911	TA DESIGN	Reimbursement of conservation design activities by a technical service provider.	No	AM	$0
912	TA APPLICATION	Reimbursement of conservation application activities by a technical service provider.	No	AM	$0
913	TA CHECK-OUT	Reimbursement of conservation installation activities by a technical service provider.	No	AM	$0

HAMILTON County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov

A-6, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	HAMILTON	**FIP Code:**	48193
Fiscal Year:	2005	**Cost List:**	TXHamiltonEQIP 200205-03	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	HANDCUTTING	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$20
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$30
314	Brush Management	MECH. BRUSH TREAT. - HEAVY - STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$185
314	Brush Management	MECHANICAL BRUSH TREATMENT - NORMAL	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac.	AC	$90
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac.	AC	$8
528A	Prescribed Grazing	PRESCRIBED GRAZING INCENTIVE	Grazing will be managed according to a schedule that meets the needs of the soil, water, air, plant and animal resources and the objectives of the resource manager.	ac.	FR	$17
550	Range Planting	W/ HEAVY EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$100
550	Range Planting	W/ LIGHT EQUIP., SEEDBED PREP., SEEDING OP. & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac.	AC	$50

A-6, cont.

910	TA PLANNING	Reimbursement of conservation planning activities by a technical service provider.	No	AM	$0
911	TA DESIGN	Reimbursement of conservation design activities by a technical service provider.	No	AM	$0
912	TA APPLICATION	Reimbursement of conservation application activities by a technical service provider.	No	AM	$0
913	TA CHECK-OUT	Reimbursement of conservation installation activities by a technical service provider.	No	AM	$0

HAMILTON County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov

A-6, cont.

NRCS Program Costs

Updated 05/02/2006

State:	Texas (TX)	**County:**	HAMILTON	**FIP Code:**	48193
Fiscal Year:	2006	**Cost List:**	TXHamiltonEQIP 200206-07	**Description:**	Leon River Restoration Project

Practice Code	Practice Name	Component	Description	Unit Type	Cost Type	Unit Cost
314	Brush Management	INDIVIDUAL PLANT TREATMENT (IPT)	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$30
314	Brush Management	MECH. BRUSH TREAT. - HEAVY - STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$200
314	Brush Management	MECH. BRUSH TREAT. - MEDIUM - STACK & PILE INCLUSIVE	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$140
314	Brush Management	MECHANICAL BRUSH TREATMENT - LIGHT	Remove, reduce or manipulate brush species to achieve the desired plant community.	ac	AC	$60
338	Prescribed Burning	PRESCRIBED BURN	Apply controlled fire to predetermined area.	ac	AC	$8
550	Range Planting	SEEDBED PREP., SEEDING OP., PACK & SEED	Establish adapted perennial vegetation to restore a plant community similar to historic climax or establish the desired plant community based on land manager's objectives.	ac	AC	$60
910	TA PLANNING	TA Planning		NO.	AM	$0
911	TA DESIGN	TA Design		NO.	AM	$0
912	TA APPLICATION	TA Application		NO.	AM	$0
913	TA CHECK-OUT	TA Reimbursement for Construction Check-Out		NO.	AM	$0

A-6, cont.

HAMILTON County Office Information	This data is from a April 29, 2006 download of the ProTracts cost data. We will continue to update this dataset from ProTracts on a monthly basis. ITC will develop a better site later for use with eFOTG. Please send any comments to David.Buland@ftw.usda.gov See also www.Economics.nrcs.usda.gov

VITA

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Education:

- Master of Science, Rangeland Ecology and Management, Texas A&M University, College Station, Texas 2007
- Bachelor of Science, Natural Resources and Environmental Sciences, Biological Science Option, University of Illinois, Urbana, Illinois, 2002.

Professional Experience:

- The Nature Conservancy, Uvalde, Texas
  Western Rivers Field Representative, February 2007 – Present
- Texas Agriculture Experiment Station, College Station, Texas
  Research Assistant, January 2005 – January 2007
- Texas A&M University, College Station, Texas
  Summer Field Technician, May – August 2005
- The Nature Conservancy, Clear Lake, South Dakota
  Preserve Management Assistant, Seasonal: September – October 2004
- The Nature Conservancy, Leola, South Dakota
  Preserve Management Assistant/Burn Crew Member, Seasonal: April - September 2003; October 2004
- The Nature Conservancy, Babson Park, Florida
  Fire Strike Team Crew Member, Seasonal: January – July 2004
- The Nature Conservancy, Franklin Grove, Illinois
  Stewardship Assistant, Seasonal: June – October 2002, January – April 2003 September – December 2003

Fire Training:

- S-131: Advanced Firefighter Training, Texas Forest Service, 2007
- S-290: Intermediate Wildland Fire Behavior, Texas Forest Service, 2007
- S-211: Portable Pumps and Water Use, Florida Division of Forestry, 2004
- S-212: Wildfire Power Saws, Florida Division of Forestry, 2004
- S-214: Southern Area Wildland Engine Operations, Florida Division of Forestry, 2004
- S-130/190: Basic Wildland Fire, Department of Natural Resources, 2002